A NEW APPROACH TO IMPROVING ENVIRONMENTAL MANAGEMENT IN THE OIL & GAS INDUSTRY IN THAILAND

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I dedicate this thesis to .....

- *my strong, tough, kind, generous Dad and my loving Mom, who taught me well the meaning of the word " persistence" and "never give up"*
- *my kind uncles*
- *my dear sister, brothers and family*

" who I love so much"

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LIST OF ABBREVIATIONS

BBL	One barrel of oil
BCM	Billion cubic metres
BOPD	Barrels of oil per day
BS	British Standard
CAC	Control and Command
CHARM	Chemical hazard and risk assessment model
DoE	Department of the Environment
DTI	Department of Trade and Industry
EA	Environmental Agency
EIs	Economic Instruments
EU	European Union
FEPA	Food and Environment Protection Act
FCCC	United Nations Framework Convention on Climate Change
HSE	Health and Safety Executive
IPC	Integrated pollution control
ISO	International Standards Organisation
MAFF	Ministry of Agriculture, Fisheries and Food
MARPOL	Convention for the Prevention of Pollution from Ships
MMSCFPD	Million of cubic feet per day
MPCU	Marine Pollution Control Unit
OCNS	Offshore Chemical Notification System
OET	Offshore Emergency Team
OECD	The Organisation for Economic Corporation and Development
OSD	Offshore Safety Division

OSPAR	Convention for the Protection of the Marine Environment of the North East Atlantic
PARCOM	Paris Commission
SEPA	Scottish Environmental Protection Agency
SOAEFD	Scottish Office Agriculture Environment and Fisheries Department
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKOOA	UK Offshore Operators Association
UNEP	The United Nations Environment Programme
US	United States (of America)
US EPA	United State Environmental Protection Agency

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ABSTRACT

This research was undertaken in an attempt to find new environmental management approaches, strategies and procedures suitable for the upstream Oil & Gas Industry in Thailand and which would be most applicable (practical and reasonable) and suitable to the situation of the country. Current management frameworks in various developed countries were reviewed, compared and analysed to select criteria most applicable to Thailand. The research has found that Thailand's industry is smaller scale and younger than the others, and its provisions for environmental management are only very basic in comparison. There are few laws or regulations, standards, and guidelines that deal specifically in detail with the environmental management of Thailand's upstream oil & gas industry. The Department of Mineral Resources (DMR) under the Ministry of Industry is the only key authority directly acting as a 'one-stop-shop' responsible for the upstream oil & gas industry in Thailand. The functions concerned with environmental protection involve the enforcement of Petroleum Acts and Regulations, and safety and environmental standards but, because of the lack of environmental regulations, rules and standards for petroleum development, DMR can not be regarded as an active agency dealing with environmental matters.

The UK has fuller and more definitive provisions, including standards and systems for levying penalties, and as such they are more akin to the command-and-control regulatory systems that have evolved in the more developed countries. There are many existing Acts and regulations affecting offshore oil & gas activities in UK. There are some strengths of the UK system which could be applied to Thailand. Pollution quality control by limiting the concentration of the discharge (standards) from oil & gas activities in the UK, USA, and the Netherlands are universal in their application and probably reasonable. Thus, these standards should be practicable for application to Thailand. On analysis of some of the new approaches (Environmental Covenants, STAR Producer Program), in the case of Thailand, it is considered that the country is not yet ready for these approaches because they require a mature environmental policy. Some part of the Asian Development Bank's recommendations however could suit Thailand in this situation.

This research has lead to certain conclusions and recommendations for environmental management in Thailand. The main recommended priority is that DMR should set up a formal action team in the short-term to have specific responsibilities for driving environmental compliance and enforcement related to oil & gas activities. This team should prepare an action plan to enhance the regulatory framework and DMR capacity building. This planning is necessary for long term development and has to be implemented seriously.

Section 1

INTRODUCTION

1.1 STATEMENT OF PROBLEMS

Presently, many countries are suffering from environmental problems because of industrial development. Some problems have become international and /or world problems. Thus, environmental issues are receiving increasing attention in many countries, resulting from growing public and government concerns and the influence of NGO's, and pressures group, some of which include international groups. Governments are now enacting appropriate legislation and regulations to protect the environment not only at national level but also international too.

Such as the United Nations Environment Programme (UNEP) is raising global awareness of environmental issues by providing the technical and public information to mobilize nations and people to take environmental action by promoting the concept such as " Saving the Environment is Your Business Too" *(UNEP,1992).* The World Bank Environment Strategy for Asia recommends that development projects should take "win-win" approaches with economic as well as environmental benefits *(Carter and Ramesh, 1993).*

Petroleum exploration is increasing at a rapid rate in many parts of the world. Upstream (Exploration and Production,E&P) oil and gas industries could play a significant role in the country's economic development. However, it could also have serious adverse environmental impacts if appropriate protection and restoration measures are not taken. Like most industries, environmental impact from oil and gas operations are inevitable. "Without efficient environmental management, discharges and accidents from petroleum operations and their impact can be quite disastrous" *(Taranajesda,1996).*

The World Petroleum Congresses mentioned that environmental consequences may occur from the production, transformation and consumption of oil and gas unless particularly environmental management and the available control technologies are used *(Salazar,1994).* The main environmental hazards associated with petroleum operations are impacts caused by effluent and emission, i.e. discharges of chemicals and additives, oil concentration in produced water, oily cutting, drilling mud , gas flaring, oil tanker traffic etc., and from accidents, i.e. oil spills and oil seepage *(Taranajesda,1996).* Loss or damage to fishing stocks due to poorly planned or managed seismic programs, and the side effects of onshore supply and storage sites. Field development and production, when they come, bring the increased hazards of onshore construction, installation of offshore platforms.

However, all these environmental impacts and risks can be managed to prevent any operational spills or controlled discharges by good industrial practices. With increasing awareness about environmental consequences, clear and efficient regulations are being demanded to minimize environmental deterioration *(Taranajesda,1996).* Greater attention is being focused on environmental aspects of the oil and gas industry in many countries. The environmental administrations are requiring higher standards and more good practices. However, the poor history of operations will shadow a company from one country to another.

Very few countries or companies in the East-West region have as yet developed and adopted detailed environmental guidelines for offshore exploration and production. Local communities have little opportunity to know about what will impact on their lifestyle or environment. Only the operators know the consequences of damaging the environment, the responsibility for protection therefore must depend on them.

The search for petroleum in Thailand began in 1921. Since 1971, a total of 13 rounds of concession bidding has been completed, 104 applications submitted and 47 concessions awarded

(DMR (1),1996). Up to 1996, Thailand has announced a total of 15 rounds. To the end of 1995, the total number of wells drilled in Thailand was 1,344 *(calculated from DMR (1),1996 and DMR(2),1996).* Over 20 fields are producing hydrocarbons and several development projects are planned. Thailand has a total of 29 concessionaires in 44 exploration blocks, 18 onshore and 26 offshore *(Taranajesda,1995).*

No serious environmental problems have occurred so far in Thailand. The main factor is from the awareness and excellent co-operation from concessionaires toward environmental conservation but not from stringent rules or regulations *(Taranajesda,1996).* There are currently very few laws that deal with environmental management for oil & gas industry in Thailand and all the laws has no guidelines in detail or a special standard *(ADB,1993; Taranajesda,1995; UNOCAL,1995; Kriangkrai, 1995; the Report to DMR,1996; Taranajesda,1996).* The legislation is not being diligently enforced *(UNOCAL,1995).*

Only Environmental Impact Assessment (EIA) is new required for oil & gas activities of 'all capacities' in Thailand by Notification No.3 which was enforced on January 1996 under the Enhancement and Conservation of National Environmental Quality Act 1992, Section 46, (*MOSTE, 1994).*

The Department of Mineral Resources (DMR), as a key government agency which is in charge of the petroleum exploration and exploitation, has increased attention on environmental protection for oil & gas industry. Due to the lack of regulations, rules, and standards for environmental matters in the field of petroleum development, DMR cannot act as an active agency dealing with environmental matters. At present, DMR seems to rely on rules and standards brought in and exercised by international aspects of petroleum development. DMR depends heavily on practices adopted by oil and gas companies.

In 1993, DMR received technical assistance from the Asian Development Bank (ADB) in drafting the rules and regulations on the environment for the petroleum operations. It is anticipated that many, if not most, of the recommendations of ADB's constancy team will be adopted. As of the middle of 1997, only initial steps have been taken towards implementation of the report's recommendations.

In order to effectively and efficiently oversee matters on environmental protection for oil & gas industry in Thailand, DMR needs to revise its roles and existing rules and regulations on these matters. The researcher is convinced that to be effective in managing the environment, an environmental management system needs to be developed based on the specific features of the regulatory and institutional machinery. Successful environmental management can only be achieved by giving a proper level of consideration to the factors of each of the systems. The problems caused by the institutional and regulatory factors are very important in determining 'specific environmental management strategies' which must be taken into consideration.

New environmental management approaches and strategies related to upstream Oil & Gas Industry in Thailand require to be drawn up in guidelines for implementation and measures which are suitable to the situation of the country in order to achieve the desired purpose and results according to the needs of the country.

1.2 OBJECTIVES OF STUDY

The purpose of this research is

1. to review and discuss the current situation of Thai and UK environmental management governing framework related to E&P operations;

2. to review the new approach, environmental voluntary agreement, related to environmental management for E&P industry in USA and the Netherlands.

3. to compare the approaches to environmental control and management of the oil & gas industry in Thailand, the UK, USA and the Netherlands;

4. to select criteria most applicable to Thailand.

5. to recommend new environmental management approaches, strategies and procedures suitable for upstream Oil & Gas Industry in Thailand and which would be most applicable, 'practical and reasonable', and suitable to the situation of the country;

6. to draw up guidelines for implementation and measures.

This aim will be achieved by:

1. Comparing and contrasting the existing legislative framework for Environmental Protection related to E&P activities;

2. Investigating and characterizing the operational approaches and environments in each country;

3. Describing and assessing the success of environmental management systems for oil & gas industry in each country.

4. Establishing the practical approaches to these issues and to formulate preliminary guidelines for a possible framework of establishing an operational system in Thailand. The guidelines should have a greater focus on technical studies and have a clearly defined path to DMR implementation.

5. Preparing an action plan for environmental management in Thailand related to oil and gas industry will be guided by the findings of the thesis.

6. Providing a basis for oil company and government negotiations in the setting of **'environment contracts'** related to conditions in petroleum development in Thailand.

7. Discussing more specific description of environmental requirements and responsibilities on each major stage of operation i.e. exploration, project development, production and abandonment will be discussed.

1.3 SCOPE OF WORK

1. The research will focus on Environmental management (*Legislative and Institutional framework*) related to upstream E&P industry in Thailand and UK by reviewing these **in detail.**

2. **A specific** study will look at '**Environmental Voluntary Agreement** which are being used in the Netherlands **[Contracts (Ct) & Covenants (Cv)]** and in United States of America [Natural Gas Producer STAR Programme]. The **reasons** are

   - The Environmental Voluntary Agreement is the new approach of environmental management applied to the E&P industry which are being introduced and used in USA and the Netherlands.

   - There is now a considerable literature on environmental management regarding E&P industry in Thailand. There is no research which presents *new approaches, such as environmental contracts & covenants, to effective environmental management for oil and gas industry in Thailand.*

1.4 METHODOLOGY OF STUDY

The methodology of study was based upon the following approach

1. **reviewing the literature**, the study was desk-based to consider ***all possible sources*** of data and information available on relevant environmental protection by assembly, review, and summary of relevant country literature (including many unpublished documents);

2. **direct inquiry** with oil and gas industry and government organizations;

3. **Interviews** were conducted with government and agency officials, with representatives of industry, with researchers in universities, with consultants in each of the jurisdictions analyzed.

4. ***analyses*** of existing data and information by

   - define the basic elements of an 'ideal' system, the system must include all the functions of a management system: (think, plan, do, measure, think etc.). Include a definition of the overall aims of the system - i.e. what it will try to achieve,

   - construct a flow diagram to show the key organizations and information flows (e.g.: focus on main problems and data requirements, problem evaluation and prioritization, goal-setting, allocation of resources, verification),

   - define key decision criteria for selecting a system for Thailand ('musts' and 'wants') - e.g. low cost, transparency, focus on main issues, ease of use etc.

- carry out SWOT analysis for all countries, at two levels:

    a) regulatory framework;

    b) enforcement agencies.

  This should assess the effectiveness (i.e. performance compared to the problems) and efficiency (i.e. performance compared to costs) of each country's system. List all S-strengths, W-weakness, O-Opportunity, and T-threat factors,

- Discuss extent which the 'ideal' system can be built for Thailand, and highlight assumptions and areas of uncertainty,

5. **recommend** the **'practical approaches'** to these issues and formulation of preliminary guidelines for establishing an environmental management system relating to E&P activities in Thailand.

1.5 STRUCTURE OF THIS THESIS

The remainder of this thesis is organised as follows: in the next Section, relevant papers review, review of the most updated information, opinion, and recommendation which are of particular relevance to this research. Section three, an overview of offshore E&P processes and their main impacts on marine environment. This Section gives the information about the sources the impacts and how serious impacts can be. Section four, environmental management review, concentrates on a comprehensive review of general current environmental management policy, strategies, techniques which are used worldwide. Attention is given to an idea to apply for oil & gas activities. Section five, characteristics of oil & gas industry in Thailand and UK, presents updated information about the situation of the oil & gas activities and their main current impacts in Thailand and UK.

Section six and seven closely examine how the present environmental legislative and institutional framework affect oil & gas industry in Thailand and in UK, respectively. Section eight examine a new interesting approach and future trend on environmental management for oil & gas activities in the Netherlands and USA.

The final Section (nine) analyses the current situation and main problems of environmental compliance and enforcement framework of Thailand and UK. The weakness, strengths, opportunities, and threats of both countries are pointed out. The relevant legislation and authorities framework are compared between the two countries. The new approach of environmental management in the Netherlands and USA are analysed for suitability for Thailand. The section also gives recommendations for Thailand, particularly the Department of Mineral Resources (DMR).

1. 6 DEFINITION OF TERMS *(In this Study)*

"OIL & GAS INDUSTRY"	means the exploration, production, storage, transport of petroleum;
"PETROLEUM"	means crude oil, natural gas, natural gas liquid, by products and other naturally occurring hydrocarbons in a free state, whether solid, semi-solid, liquid or gaseous, and it shall include all heavy hydrocarbons that can be recovered in situ by thermal or chemical processes, but shall not include coal, oil shale or other kinds of rocks from which oil can be extracted by application of heat or chemical process;
" PETROLEUM FIELD "	means a single separate economic development;
"EMS - ENVIRONMENTAL MANAGEMENT SYSTEM"	means as the organizational structure, responsibilities, practices, procedures, processes and resources for implementing environmental management;
"ENVIRONMENT QUALITY"	means the balance of nature, i.e., fauna, flora, natural resources and man-made things, which is for the benefit or livelihood of the people and the sustenance of human beings and nature;
" POLLUTION "	means the release from any process or substances which are directly or indirectly capable of causing harm to man or any other living organisms supported by the environment;
" LEGISLATION "	means acts, regulations, commissions etc. which are related to the oil & gas industry and its relationships with the environment.

Section 2

RELEVANT PAPERS REVIEW ON ENVIRONMENTAL MANAGEMENT GUIDELINES FOR THAILAND'S UPSTREAM E&P INDUSTRY

2.1 Introduction

There have only been two main reports in Thailand which closely relate to the research of the present study. The first was conducted by the Asian Development Bank (ADB) in 1993 and the second was carried out by the author in a report to Department of Mineral Resources (DMR) in 1996 for her employers during a six months suspension in her PhD registration studies. These two reports studied in detail Thai Acts, Regulations, Standards and institutional/ administrative capacities. There are other papers which are presented by other DMR officers and oil companies related to this research too but they are not in detail.

2.2 Asian Development Bank Report (ADB, 1993)

In 1993, the DMR of Thailand received technical assistance from ADB to study standards and regulations for upstream E&P industry. The following December, a 278-page ADB's report was submitted to the DMR. The current status of the industry and the regulations were summarized. The E&P operations were examined and recommendations of improvement were made in the regulations and DMR's institutional capacity. The report's main conclusions and requirements are summarized in Table 2-1 and Table 2-2 as shown below.

Table 2-1 Strengths and Weaknesses of Thai legislation / regulations and Institutional process

Legislation & Regulations : Strengths
1. There are theoretical opportunities to clarify and consolidate the regulatory framework, by using Ministerial Regulations and DMR announcements.
Legislation & Regulations : Weaknesses
1. At present, there are no law and regulations that specifically address the E&P industry. 2. The Enhancement and Conservation of National Environmental Quality Act 1992 does not embrace the E&P industry. 3. The document 'Laws and Standards for Pollution Control in Thailand' does not specify which requirements are intended for the E&P industry. 4. The only provisions made in the Petroleum Act are unworkable vague and indecisive. 5. Ministerial regulations have not been sufficiently used to fill the regulatory void. 6. Insufficient numbers of DMR announcements have also been issued to address the regulatory weaknesses. 7. There are currently no formal environmental reporting requirements and procedures to allow DMR to make decisions. 8. There are presently no formal EA requirements or procedures. 9. Co-operation between DMR divisions and between DMR and other departments are not as effective as they should be.
Institutional Process : Strengths
1. The Petroleum Act's environmental provisions are flexible and therefore can easily be built on in the process of institutional strengthening. 2. Ministerial regulations can be further used to: • extend national environmental assessment and approval procedures to E&P; • impose minimum technical standards and guidelines; • establish sector-specific environmental and safety quality standards.
Institutional Process : Weaknesses
1. There are no formal environmental reporting or management procedures for the upstream oil and gas industry. 2. DMR officials are not involved in the environmental management of the upstream E&P industry.

Table 2-2 Main issues required for Upstream E&P Industry in Thailand

Requirements : Institutional processes
a) The institutional processes should be strengthened, and DMR should retain responsibility, as **'one-stop-shop'** b) A three-tier screening process should be introduced as follows: 1. **APDA** (Application for Petroleum Development Activities)- all significant projects involving : • seismic surveys • installation of additional pipelines to existing pipeline corridors/ racks • drilling of additional wells from existing and permitted drill pads • transporting of additional petroleum volumes by existing routes 2. **Environmental Review (ER)** for projects with impacts that are insignificant, manageable, short term such as in the case of : • seismic surveys in sensitive areas, or where substantial new roads are needed • drilling new wells from new pads • expanding existing site by more than one additional well • expanding road or rail system to accommodate increased petroleum volumes 3. **Environmental Impact Assessment (EIA)** for projects warranting detailed management and monitoring programs such as in the case of : • development and production at a new site • development and operation of a new pipeline system • prior to release for bid of a new concession

Table 2-2 Main issues required for Upstream E&P Industry in Thailand *(continued)*

Requirements : Waste Handling
1. all non-liquid oil contaminated wastes shall be contained onsite for subsequent treatment and disposal. The level of treatment shall be in accordance with the proposed standards contained within the 1989 Law and Standards of Pollution Control in Thailand; 2. oil wastes from machinery spaces shall not exceed 100 ppm oil, as required under the MARPOL Convention 73/78; 3. the disposal of oil-based mud cutting in water depths of less than 15 m or within 5 km of a sensitive resource; 4. a Hazardous Products Identification Scheme to control the use, storage, transportation and disposal of hazardous waste products and the emergency response procedures that shall be followed in the event of accidental discharges; 5. the requirement to treat formation water if the average monthly hydrocarbon content exceeds 40 ppm at the discharge point; 6. the discharging of formation water is prohibited with hydrocarbon concentrations greater than 40 ppm (monthly average) in depths of less than 15 m or within 5 km of a sensitive resource; For the purpose of waste control, DMR should : • conduct periodic compliance audits of petroleum facilities; • set EIA standards and provide guidance on EIS preparation; • amend the relevant regulations to reflect the report's recommendations; • place greater emphasis on environmental management in accordance with Ministerial Regulation No. 17. The operators should: • prepare a fully documented and audible hazard analysis for each of their facilities; • wherever possible, improve their reporting and spill notification requirements; • maintain their inventories of all solid, gaseous, and hazardous waste; • wherever possible maintain or change management policy to ensure least environmental impacts from operational changes; • provide annual report of total environmental loadings;
Requirements : Reporting
The operators shall submit to DMR the following : 1. annual reports on the total volume of discharges, emissions, and waste disposed of for each activity during the previous 12 calendar months; 2. an inventory of oily substances that will be used on-site and that have the potential to be discharged to the environment; 3. an inventory of gaseous wastes which shall include details on the flow rates and gas flow composition for all emissions, an assessment of the combustion/conversion efficiency for flares and turbines, and an estimate of the total annual output of contaminants; 4. an inventory of all potential and identified hazardous waste materials; 5. prepare and maintain a change to management policy. (This policy shall include a provision that all changes which have the potential to impact the safe and environmentally-responsible management of a facility shall be reviewed by competent personnel prior to implementation); 6. prepare a management and monitoring program for all hazardous wastes and incorporate the provisions of the Hazardous Products Identification Scheme; 7. undertake a hazard assessment of producing facilities, pipelines, processing equipment, terminals and other associated operations which shall be fully documented and audible; 8. submit to DMR an application and unattached site location and development plan prior to the commencement of site preparation activities.

2.3 The Industry's Response to the ADB Report

The industry's responses to the ADB draft report and the ADB final report were submitted to DMR at about same time. In critical response to the ADB draft report, the industry prefers a **'self-regulation'** system. The response paper's objectives, conclusion and recommendations are shown in Table 2-3 below.

Table 2-3 Main points of E&P industry's response to ADB recommendations

Issues
Specific objectives : 1. to present an overview of 'environmental activities' being undertaken; 2. to summarize major issues and give an assessment of the problems to consider 3. to assess the ADB report in view of the Thai petroleum industry's working experience
Conclusions : 1. 'While the final draft... is a comprehensive reference document, **it does not reflect Thailand's needs**' (bold print reproduced from original). 2. The industry chose to draw attention to the 'sound' environmental track record. 3. The proposals represent 'heavy financial burdens' for both industry and government. 4. The first step towards a regulatory framework that 'suits Thailand's needs' are the Guiding Principles for Environmentally Responsible Petroleum Operations. 5. Emphasis should be on 'planning & environmental screening and evaluation [sic] where environmental concerns can be identified as part of the initial approvals procedure'. [i.e. there should be a sound EA regime] 6. This approach should be combined with 'occasional environmental audits'
Recommendations : 1. Promote corporate responsibility without implementing a burdensome framework 2. Introduce an environmental management system [both for individual concessionaires and industry-wide] by developing codes of practice 3. Establish a screening process to relate EIA requirements to environmental concerns 4. Use the same screening process to set requirements for environmental monitoring programs 5. Consider waste management plans as a code of practice 6. Reduce unnecessary reporting by promoting internal audits, applied by both industry and government, 'when determined appropriate' 7. DMR to consider the industry's detailed comments, and hold further discussions with the industry before implementing any new measures
Guidelines : 1. Eleven principles were 'established internationally', and are based largely on the guidelines of the International Petroleum Industry Exploration and Production Forum ['E&P Forum'].

2.4 Outline of Report (1996) to DMR

2.4.1 Critique of the ADB Consultants' Recommendations

The report to DMR (1996) mentioned that "The central themes of the ADB consultants' report are that the present regulatory framework and institutional capacity are severely inadequate, and require extensive improvements. The author agrees with these conclusions, but stresses that it must be recognized that DMR is unlikely to be allocated sufficient resources to be able to effectively undertake the scope of work that is called for. This is largely because the recommendations are heavily prescriptive, and would result in a massive workload for DMR. DMR does not have the financial, organizational and skills resources to cope with such a workload.

The detailed report requirements would also present unreasonable challenges to the industry, resulting in cost and time hurdles. As far as practicable, the new system should, however, be built around corporate environmental (including health and safety) management systems, with associated standards and relevant reporting requirements, backed by a recognized commitment to effective enforcement. This is essentially in line with the view of the industry. The report (1996) pointed out that "In comparison to Thailand's major environmental problems, the government should uniquely regard the offshore E&P activity as sufficiently important so as to justify the expense of adopting the whole of the ADB report. An effective low-resource system should be built around:

- definition of impacts of concern
- definition of EIA requirements and standards
- definition of EMS requirements, standards, targets, and timescales
- periodic DMR audits
- all the above systemised within 10-15 year environmental covenants, which are recommended to a new practical approach for upstream E&P Industry in Thailand. (See more details in Section 9)

The report (1996) recommended that "The ADB report has now been with DMR since December 1993 (so has the industry response paper), but as yet relatively little further action has been taken to implement its recommendations. This was the first comprehensive study to address the provisions for environmental management in Thailand's E&P industry, and this report took over twenty years to appear.

As a result of the poorly developed regulatory framework, DMR has not had the comprehensive legal backdrop which would serve to 'drive' its environmental management efforts. This problem arguably is reflected in the DMR's present policy, strategy, goals, and work plans. Based on the analysis of these opposing viewpoints, the author believes that the optimum options for future change must lie in an appropriate compromise. This should seek to combine the main potential benefits available, but minimize the disadvantages inherent to each proposal. The role of DMR could be to facilitate and to help guarantee the enhancement, towards particular desired goals, of the companies' existing environmental management capabilities.

For the new framework, the report to DMR (1996) pointed out that the MOI / MOSTE Joint Committee petroleum environmental task force has still not issued its opinions of the ADB report. In particular, there has been no decision about what aspects and provisions of the report are regarded as of highest priority. The industry, meanwhile may present the government with its own detailed proposals, representing a *fait accompli.*

2.4.2 Critique of the Industry's Recommendations

The report to DMR (1996) pointed out that " In its response paper to the ADB consultants' report, the industry stressed that it does not see the need for more stringent regulation. Much debate centered on about the likely costs to be incurred in such proposals - both to the DMR and industry. The report also went so far as to call for 'self-regulation', based on voluntary guidelines for Thailand, which would in turn be based on international industry voluntary guidelines.

It was stated that the present regime is regarded as sufficient (Upstream Petroleum Industry Task Force, 1995 : 15). The author disagrees with this last point, but feels that self-regulation should be a fundamental pillar of the future regime, alongside active government participation. Such a system should be built around corporate environmental management systems. The opposing viewpoints between ADB and oil companies' recommendations are shown in Table 2-4 below.

Table 2- 4 Opposing Viewpoints of Petroleum Industry and ADB Recommendations

Industry's Response ←==================→	**ADB Report**
- Present regime is fine	**- Present regime far too rudimentary**
- No need to strengthen regulations	**- Much more regulation needed**
- 'Self-regulation' is best	**- Money no object for industry and DMR**
- Use voluntary codes of practice	**- Use prescription and enforcement**
- Base framework around EMSs	**- Base framework prescriptive standards and reporting**

The ADB consultant report and the industry response paper views seem not to the in-line. The ADB report calls for a substantial tightening up of the regime, with more stringent requirements, whilst the industry response paper defends the *status quo* and promotes the concept of industry self-regulation." The report to DMR (1996) mentioned that the response was intended to 'enhance DMR's understanding of the effect of the additional requirements being suggested'. In the subsequent letter of transmittal by the industry, it was stated that the industry wishes to highlight Section 75 of the Petroleum Act. This is taken to mean that the provisions of this Section are at least substantially adequate to outline the legal requirements. Section 75 is quoted below:

'In conducting petroleum operations, the Concessionaire shall take appropriate measures in accordance with good petroleum industry practice to prevent pollution of any place by oil, mud or any other substances. In the event that pollution of any place by oil, mud or any other substances result from the petroleum Concessionaire's petroleum operations, the Concessionaire shall take immediate action to combat such pollution'. Section 75 is considered to be flexible but it could be more detailed.

With regards to the guiding principles, which the industry set out and claims to hold to, the report to DMR (1996) stated that they were 'established internationally', and are based mostly on the guidelines of the International Petroleum Industry Exploration and Production Forum ('E&P Forum'). The E&P Forum voluntary guidelines represent what the industry regarded as an acceptable international code of good industry practice, irrespective of more stringent national environmental regulations and standards. In other words, whilst a company's first priority should be given to meeting legal requirements, the requirements of 'good industry practice' should apply where these are lacking. The eleven Thai guidelines, however, do not include some important elements of the thirteen E&P Forum ones. The most significant omissions are the following highlighted key words:

- Develop **programs** to reduce overall emissions and waste generation.
- Provide advice to customers, **contractors**, or others on the safe use, handling transportation and disposal of raw materials, products and wastes from members' operations.

- Inform appropriate officials, employees, customers and the public in a **timely manner** on significant industry-related safety, health and environmental hazards, and recommend protective measures.

2.4.3 The Report to DMR Recommendations

The report's recommendations are intended to serve as the basis for enabling a comprehensive and in-depth enhancement of the whole environmental compliance and enforcement program for E&P operations in Thailand. The two main recommendations are regulation and re-organization which are proposed in Table 2-5

Table 2-5 Main recommendations of the report to DMR

Regulation
1. formal EIA requirements 2. environmental permits 3. formal requirements for environmental goals, -EMSs and EM plans 4. formal self-monitoring and audit requirements 5. DMR inspection and enforcement activities
Re-organization
1. The Petroleum environmental staff should be reorganized to form a new dedicated section. 2. The Environment section's remit should have the following main duties: • Enforcing when necessary, defining and imposing remedial actions, and application of sanctions • Inspections of facilities' records, manuals, procedures and environmental impacts listed below : - Assist with development of permit content - Feedback and follow-up - Follow-up on results of inspection monitoring - Keep records and inventories - Prepare and disseminate regulatory and technical information to operators* - Perform E&P Sensitive area or Environmental Risk mapping * (by assigning Environmental risk -E value) - Prepare standards and guidelines* - Perform environmental screening of proposed projects - Review of submitted EIAs * *some of this information could be prepared by consultant firms*

Note * *At present, DMR has 3 factors for Special Remuneratory Benefit (SRB) calculation. The factors are geological constant (K) , Special Reduction (SR) and cumulative well depth. SRB is designed for extra government's take from windfall profit which will only be used if: all capital costs (plus special reduction) are recovered, and annual revenue become drastically high compared with the investment (i.e. unusual high oil prices)*

DMR has re-evaluated the geological data, exploration and production difficulty of exploration blocks in different areas including the investment climate and competition in the region and came up with more incentive for K and SR values for the blocks to be opened for bidding in the next licensing round. Due to the high costs of environmental protection, especially in some sensitive areas, the E value should be added as one factor for SRB calculation that will be more reasonable for the industry.

2.4.4 The Report to DMR Conclusion

The main problem areas of environmental management related to upstream E&P industry in Thailand can be concluded as follow :

1. Thailand has no detailed laws, regulations and standards for the environmental management of the E&P industry.
2. The Petroleum Act has not been sufficiently expanded and up-dated so as to effectively address environmental issues.
3. The act concerning the environment in Thailand [ECNQA], whilst it is fairly rigorous, does not embrace the E&P industry.
4. The DMR has been unable to effectively conduct supervision of the industry's environmental management efforts. This is largely due to the regulatory void, an unclear remit, inadequate organization, poor goal setting and performance measurement, and shortages of skilled personnel and equipment.
5. The ADB consultants' report is comprehensive and detailed, but is unrealistic given the country's stage of economic and social development.
6. The industry's response paper to the ADB report was mostly well-balanced, but the suggestions for a proposed future regime are considered as insufficiently detailed and biased against government involvement.
7. Thailand's regulatory framework is substantially less advanced than those of Malaysia and Indonesia, which at least have specific requirements and standards for waste management and formalized provisions for EIA.
8. DMR already has some useful experience of the kinds of activities that would be part of any enhanced CEP - such as inspections and EIA reviews.
9. DMR has a well established and healthy relationship with the industry.
10. Currently, there is a lack of the necessary human resource requirements to run an effective CEP.
11. DMR has the opportunity to design and implement a CEP virtually from scratch.

12. The general and continuing lack of political commitment to environmental and resource management represents an on-going threat to the establishment and viability of any effective CEP.
13. Present government policy restrains staffing increases and may affect the formation of E&P Environment Section in DMR.

The report to DMR (1996) has recommended that DMR should carry out the following:

1. Conduct a full-scale strategic assessment of the issues, factors and options regarding the design, implementation and operation of an enhanced and 're-engineered' CEP for the environmental management of the E&P industry.
2. Enhance the regulatory framework towards an effective compromise between the ADB and the industry proposals. This should include definition of standards, requirements for EIA, reporting and permitting.
3. In Recommendation 2, consideration should be in line with Thailand's needs and capabilities, and with the provisions of other countries.
4. The new CEP should be considered and built around the operating companies' EMSs and provision for a mandatory ISO [International Standards Organization] or equivalent EMS.
5. Develop a simple system of environmental permitting.
6. Establish a dedicated E&P Environment Section.
7. Carry out assessment and training for staff skills requirements.
8. Conduct assessment of information management requirements.
9. Prepare action plans for the implementation of the Environment Section.

2.5 Recommendations from other sources

a) Thai Legislation and Authority :

Taranajesda (1996) pointed out that

1. .... " Despite having five agencies supervising and regulating environmental aspects of the petroleum E&P industry, Thai provisions for environmental management are still rudimentary and still to be fully instituted. At present, legislation is not being diligently enforced. There are no statutes dealing specifically with the environmental management of petroleum E&P, except two relevant acts - the Petroleum Act of 1971 and the mentioned Enhancement and Conservation of National Environmental Quality Act of 1992."

2. ..... " The Petroleum Act and related regulations have some sections related to environmental protection but are not intended to deal directly with environmental impact and have no detailed standards or guidelines. It is only the national policy that environmental impact caused by petroleum exploration and development should be at acceptable levels as those required in other sectors. "

3. .... " The present Environmental Act of 1992 has no detailed standards or regulations related directly to environmental aspects for the upstream petroleum industry until early 1996 when EIA for E&P activities was incorporated into the program."

4. .... " The Petroleum Act (1971), Section 75, which touches on environmental protection is very broad with a catch-all phase of " accepted good petroleum practices."

5. ..... " Governmental agencies responsible for auditing and monitoring of petroleum operations should review their current rules and roles on environmental protection as the dynamic changes in the environment and advances in technology have rendered existing legislations outdated and in need of improvement."

Trisarn (1992) mentioned that "owing to the relatively young age of the petroleum industry in Thailand, provisions in the Petroleum Act 1971 and amendments issued to date provide an umbrella for a wide range of environmental issues, but have little detailed regulation". He also point out that "the Act and Regulation should be upgraded to international standards by implementation by the government and outside assistants. A full-fledged environmental management system and monitoring staff should be established "

TOTAL (1995) mentioned that " Petroleum Act covers a wide range of issues, including environmental protection. .....Thai law requires an EIA for all sizes of projects concerned with natural gas separation or processing, but this is not yet a legal requirement for the offshore industry.

Taranajesda (1995) stated that " there are currently no laws or regulations that deal specifically with the environmental management of Thailand's upstream hydrocarbon industry. The Enhancement and Conservation of National Environmental Quality Act (1992) further clarified the environmental process within Thailand. He said that "neither the previous nor the current environmental legislation has specified upstream oil & gas development activities that require a detailed environmental analysis."

b) Institutional Capacity and Environmental Management

1) Department of Mineral Resources (DMR)

Trisarn (1993) stated about Mineral Fuel Division (MFD), which is one part of DMR and has responsibility directly to control upstream E&P industry in Thailand, that "the duties of the MFD related to environmental issues are: the enforcement of the Petroleum Act and Regulations, safety and environmental standards. However, due to lack of regulations, rules and standards for environmental matters in the field of petroleum development, MFD cannot act as an active agency dealing with environmental matters. At present, MFD seems to rely on rules and standards brought in and exercised by international aspects of petroleum development and depends heavily on practices adopted by oil and gas companies. This might present problems when dealing with companies which adopt lower standards of practice".

2) Waste Management

Thai Shell (1993) stated that " no specific guidelines relating to drilling/ production waste disposal methods exist in Thailand although these are being considered by an Asian Development Bank sponsored review of environmental regulations for the upstream oil and gas industry."

Texaco (1994) stated that "DMR has no definitive guidelines or regulations in place pertaining to the treatment and disposal of drilling fluids and cuttings, or accidental spillages or explosions associated with offshore exploration petroleum drilling programs".

3) Environmental Assessment Impact (EIA) Report

Sweeting (1995) pointed out that "in the quality of E&P industry environmental impact statements, the results reveal a number of common inadequacies in the EISs, in particular :

1. executive summaries are often patchy and incomplete;
2. environmental descriptions are often very insubstantial;
3. the processes of impact identification, impact magnitude evaluation, and impact significance assessment are often not carried out in a scientifically rigorous way;
4. project alternatives, impact mitigation and management are often poorly thought out.

He recommended that the DMR should issue guidelines for EIAs in the E&P industry, which would enable developers and consulting firms to produce EISs of higher and more consistent quality. Therefore, this should ultimately enhance environmental decision-making and management by both regulators and operators. DMR should also consider closer involvement in EIA scoping and to help ensure that all areas of importance are sufficiently well addressed".

5. Abandonment

Currently, There are no regulations in Thailand and SE Asia governing the handling of obsolete offshore structures *(UNOCAL,1995).* In practice, however, the policy is to remove smaller platforms, in shallow water to a depth of 200 feet, and to partially remove larger structures so that the highest part of the structure is no closer than 55 metres to the surface.

c) EC Critique on Thailand Environmental Management System pertained to Upstream Oil and Gas Development activities

UNOCAL (1994) pointed out that

- Legislation and standards are based on the American model and inappropriate in many cases.
- The design of standards is not linked to technologies that would enable industries to comply.
- The proliferation of unenforced or unenforceable regulations has created an atmosphere of tolerance.
- The factory permitting systems are not designed for close supervision by Department of Industry Works.
- There is corruption in the Public Sector.

(Source: UNOCAL,1994)

Section 3

AN OVERVIEW OF THE PETROLEUM EXPLORATION AND PRODUCTION PROCESSES AND THEIR ENVIRONMENTAL IMPACTS

3.1 Introduction

The upstream oil & gas industry can be described by four main phases, exploration, development, production, and decommissioning / abandonment. Oil and gas developments are well recognized as potential sources of environmental pollution and contributors to large environmental incidents *(Evans,1994).* The World Petroleum Congress (WPC) acknowledges that environmental consequences may occur from each phases of the activities and in all locations. The environmental impacts can occur in a variety of ways if the operators do not have particularly good environmental management and unless the available control technologies are used *(Salazar,1994).* Some impacts are an issue only at the local level, whilst some (especially atmospheric pollution) are important globally. However, results to date indicate that petroleum exploration, development, and production effects are very localized and minor, with natural recovery of impacts areas occurring *(Upstream Petroleum Industry Task Force ,1993).*

There are two essential environmental problems associated with the upstream oil & gas activities - **normal discharges** and **accidental releases**. Main normal discharges can be considered to comprise all atmospheric emissions (flaring, vents and exhausts), liquid effluence (drilling fluids / muds, produced water), solid waste (cuttings). Accidental releases may include oil/chemical spills, gas leak, fire or protective measures, and blowout.

3.2 Exploration Phases

3.2.1 Seismic Survey

Seismic survey is the first phase of any development and is aimed at identifying geological structures that might contain commercially exploitable quantities of hydrocarbons. The technique used for operating the seismic survey is based on the principle of differing reflective properties of soundwaves of the rock strata. In the case of offshore, this is carried out by a seismic survey vessel equipped in its simplest terms with a number of energy sources to generate a short impulse of noise every 30-60s, a string of receivers (or hydrophones) and vessel tracking/ record/ data processing systems. The seismic vessel will steam down preselected tracks up to 1-2 km apart firing air or water guns every 30-60s (i.e. every 25 m). In a typical survey the vessel may shoot between 500-1000 km of seismic survey over a 2-3 week period. Modern sound sources are confined explosion devices such as air guns, gas explosives, gas sleeve explosives, or sparklers that involve small, controlled charges of chemical explosives, gas or air, or electrical discharges.

Environmental impacts

Offshore : The principle concern with seismic activity relates to the possible effect of the energy source on fisheries in specific sea areas or at certain times of year and the physical presence of the seismic vessel with its towed string of receivers, often stretching several kilometers behind the vessel. The survey vessels cables (some as long as 3 km) can be a potential navigational hazard.

The type of seismic sound sources generation produces a strong compression wave that can damage the ecosystem, mainly by small fish kills and disrupt breeding near the source *(Report to DMR, 1996)*. The results of Norwegian experiments work are shown that fish eggs and larvae are most vulnerable with significant numbers being killed even at 1 m distance. There are also injuries and mortalities to fry of cod, herring and sprat at 1.3 m distance. When the chamber volume of guns or arrays totaled 5 litters or more, young fish (cod and saithe) and adult fish (cod and plaice) suffered serious damage (haemorraging in vital organs) at 0.5 m distance which increased over the following two weeks. The experiments pointed out that the safe distances from airguns are phytoplankton - 1 m, zooplankton - 2m, fish eggs and larvae - 2m, fish fry - 1.5-2 m, fish juveniles and adults - 1 m, benthic / epibenthic crustacea - 0.5 m *(CEMP(1),1996).*

CEMP(1) (1996) reported that 'effects of airguns used over protracted periods (e.g. 3 week or 3 month surveys) are not yet clear, the question being that once fish move off at the start of a survey will they stay away or will they come to accept the disturbance and return?. Effects on mammals (seals and dolphins in particular) are not yet well understood since their hearing range has not been fully determined. Observations on them in the field have shown that they hear the normal traffic noises caused by shipping in shallow and in deep waters and they have been seen to avoid very high levels of noise. From the most recent observations it has been suggested that bottle-nosed dolphins will avoid noise generated within 0.3 km distance particularly if it is very loud *(CEMP(1),1996).*

The offshore oil industry during seismic surveys and during abandonment of platforms may use explosives. Shock waves produced by high velocity explosives, no matter what size or comparative strength, will kill fish and other marine life. Generally, it is recognized that a shock wave characterized by a sharp ' spike' and producing instantaneous pressure changes exceeding 40 psi will be lethal to some fish. Explosives with the same peak pressure can have different rise times and peak pressure duration and consequently different effects on fish and mammals. (*Davies, 1992*). However, the lethal effects of a high velocity explosive are dependent on the type of explosive, water depth and the depth of the detonation within the water, the reflective characteristics of bottom sediments, and also the type of marine life.

3.2.2 Exploration Drilling

If the results from seismic surveys show a potentially exploitable geological structure, then the next phase is drilling a well into the structure to search for hydrocarbon traces. This operation can be conducted either from a drilling rig or a drill ship. The well is drilled in sections using a progressively smaller rotary bit attached via a drill string to the surface. As each section of the well is completed it is cased with progressively smaller diameter casing which is cemented into place. During the drilling operation, drilling fluid (drilling mud) is circulated down the drill string to the drilling bit and returned to the rig in the space or annulus between the drill pipe and the well casing. Prior to recirculation the drilling fluid is screened or treated to remove the drilled solids.

Functions of Drilling Muds : When drilling wells for oil & gas exploration and production, the drilling mud will have several functions to help overcome technical problems during operation. The basic functions of the drilling mud are lubricate the drill string and bit, cool the drill string and bit, clean the hole bottom, carry the cuttings to the surface, and control formation pressure. Additives have been developed to allow drilling fluids to accomplish many other tasks downhole, in addition to enhancing the capacity of the fluid to perform the basic functions for which it was designed. The secondary functions are fluid loss control, viscosity control, suspend cuttings, density control, shale control, and circulation loss control.

Types of Drilling Muds : The different muds have basically the same functions, but adjustment can be made by adding various chemicals depending on the nature of the formations in the well being drilled, and drilling technique used. A drilling mud, also called a drilling fluid, is a very complex mixture. To simplify it, the components constituting a mud can be divided in two groups; the base fluid, which is also called carried fluid or continuous phase, and additives. A specific mud-package is normally composed of one base fluid, and several additives.

The base fluid will only vary in amount or concentration, whilst the additives, on the other hand may, for one and the same mud-package, vary also in composition, depending which mud properties are desired. The formulation of one drilling mud may also change during operations, due to addition of additives or reuse of the mud. Additives are required to avoid or minimize many of these problems, which will vary from well to well. The most common additives are emulsifiers, brines, weighting agents, sealing material, fluid loss control agents, gelling products, alkaline, chemicals, heavy metals.

Heavy Metals are used during the drilling and completion of oil and gas wells, the most important of which are *lead, arsenic and chromium.* Lead is the primary component of drill collar and pipe joint thread compounds, commonly referred to as "pipe dope". These compounds often contain greater than 30% lead. In addition, chromate and arsenic have been used extensively as corrosion inhibitors and additives in drilling muds and fluids (*Tröndle, et al, 1993).*

Drilling fluid lubricates the bit and carries the drill cuttings to the surface, the cuttings have to be removed by treatment and discharged overboard from the rig before the fluid can be recirculated. The drilling fluid also provides the primary means of controlling the well by balancing the well pressure against the weight of the drill fluid column. As a precaution against the sudden imbalance of pressure, for example, if drilling into a zone of unexpected high pressure gas, a blow-out preventer (BOP) is attached to the top of the casing. The BOP is made up of a series of hydraulically operated rams which can be closed to effectively shut-in the well. ***Chemical*** additives to drilling muds were used only to increase density, or to thin water based muds. Recent advances in fluid technology and chemical use have resulted in the development of complex formulations whereby a single chemical can perform several functions during drilling. On basis of the base fluid, drilling muds can be classified into 3 types: Water based mud (WBM), Oil based mud (OBM) (now is not excepted, may be used in specific safety or operational reasons only), Pseudo oil based mud (POBM).

WBM has water as base fluid, OBM has mineral oil, and POBM has pseudo oil, or synthetic oil (sometime from vegetable oils) as base fluid. OBM, paraffinic / naphthenic, lower toxicity, used for drilling requiring high lubrication or formations which cannot be drilled with WBM alone (Shales). OBM was reclassified under new OCNS from 1996 for Category 0 (PARCOM test species) (i.e. 4 day LC50 > 10,000 ppm oil in sea water). Ideal POBM would have LC50 < 10,000 ppm (Group E), be readily biodegradable, and would not accumulate in any biota *(CEMP(2),1996). However,* use of POBM strongly controlled until proven they are more environmental friendly than OBM. Spent OBM and POBM are returned to shore. The POBMs are seen as possibly more environmental friendly, especially regarding biodegradability, than the OBMs, which biodegrade slowly in comparison. So, when the discharge limits of OBM on cuttings turns stricter during the 1980s, the evolution of pseudo oil based muds was encouraged.

The option of processing cuttings will have the benefit of recovering the used mud from the cuttings, so the mud can be reused. Most POBMs and OBMs are reusable. POBMs costs per cubic metre are significantly greater than those of OBMs. With the cost of pseudo oils ranging from £ 110-220 per bbl (mineral oil + £30 per bbl)*(Rosland,1994)*. These cost comparisons, however, are unrepresentative of actual well, drilling fluid, and drilling costs. Most of the remaining 2% of wastes is made up of drilling fluids, or 'muds'. As much as possible is usually recovered for re-use, but some, especially that which is attached to drill cuttings, is released to the marine environment with the discharge of the cuttings. Once the target depth has been reached, if hydrocarbons are present then the rock might by sampled by coring, key geophysical parameters measured (logged) and the well flowed to the surface to measure production rates (tested). Any hydrocarbons produced during the test are generally sampled and the residues burnt off or ' **flared** ' in test burners. Depending on the well potential it will either be suspended for future use (i.e. well stabilized, casing cut off at the seabed and a wellhead attached) or abandoned (i.e. filled with cement and casing cut off at or below the seabed).

Environmental Effects from Drilling Muds

Drilling muds can adversely effect the marine environment by changing the pH of the seawater, by smothering bottom-dwelling (benthic) organisms, by reducing light necessary for plankton growth or by releasing toxic chemicals that are lethal or can elicit sublethal responses such as reproductive impairment or growth inhibition. Solids suspended in drilling muds and their associated cuttings can smother benthic fauna within 200 m of a drilling platform and can adversely affect benthic fauna as far away as 2000 m *(Gulec,1994)*. Water soluble fractions and the solid phase of drilling muds can include petroleum hydrocarbons or derivatives, heavy metals, and other contaminants, The proportions of each type of toxicant depends on whether the drilling muds is oil based, water based or synthetic fluid based.

Water Based Mud : The factors determining the type of effect elicited are not clear. The use of water based drilling muds barely shows an impact beyond that of physical disturbance in which smothering by the cutting pile appears to be the most important factor, although residual toxicity and organic enrichment may also have a significant effect (*Davies,1992*). However, the mercury and cadmium content of some barite (Barium Sulphate Ore) has come under scrutiny.

Oil Based Mud : As already indicated, using oil based mud results either in an organic enrichment or toxic effect. *The switch from diesel to alternative base oils dose not appear to have made much difference to the impact on the environment* (*Davies, 1992*). In some cases the use of alternative base muds may result in reduction of individual abundance suggesting a toxic effect. This, in turn, suggests that the base oil may not be the critical factor determining the toxicity of a particular drilling mud formulation. An environmentally less friendly waste stream is created when OBM is in use. Biological effects are observed to within a radius of 500 m of the discharge point. These effects are associated with the smothering of the seabed and its organisms and are sustained by the anaerobic conditions created by the oil associated with the cuttings.

Environmental Effects from Drilling Cuttings

The oil based muds which are reusable are recovered before the cuttings are discharged into the sea. The cuttings, after cleaning, are still contaminated with some oil, and in most cases still are normally dumped overboard blanketing the seafloor around the installation. Nevertheless, until recently the cutting would contain 10-17% of oil by weight which had originated from the muds. By weighing the cuttings discharged and comparing the weight with the theoretical value based on the volume of the well, discrepancies of 50% have been recorded, the difference being attributed to unseparated mud still with the cuttings. The implication of this is that more oil may be discharged in this way than is being recorded using present methods of assessment.

Two types of adverse effects of discharges of cuttings can be distinguished: physical smothering and chronic pollution of the benthos. Of these, only the latter will be discussed here. Based on the relative abundance of sensitive species and the species diversity, the no observed effect concentration (NOEC) for macrobenthos is ca. 10 mg/kg. dry weight of sediment *(ICES, 1993).* Above this level, a variety of effects become visible, such as reduction in number of sensitive species, increase in abundance of some opportunistic species, increased mortality, overall reduction in macrobenthos abundance, and reduced diversity of the whole marcrobenthos community. The adverse effects can be described as follows:

- concentrations > 100 mg/kg dry sediment : all types of effects occur from moderate to severe;
- concentrations <100 and >10 mg/kg dry sediment : at least some of the above (moderate) effects occur;
- concentrations >ca. 10 mg/kg dry sediment : sensitive species are absent or present in reduced densities, but opportunistic species increase in abundance (subtle effects) *(Source: ICES, 1993).*

In the case of North Sea (UK sector) very high concentration (between 1,000 and 10, 000 times background) are apparent close to the platforms with a steep downward gradient in the region of 500 - 1,000 m from the installation, reaching minimal levels beyond 2, 000 m (*Davies, 1992*). This pattern hold for most installations in the North Sea, the spread of contamination being exaggerated along an axis corresponding with the residual tidal current flow in the area.

Typical concentrations in remote areas are normally in the range of 0.2 - 5 mg/kg dry sediment, although in some areas of the UK sector values in the range of 15 mg/kg dry sediment are found. Very close to platforms (within 50 m) oil concentrations as high as 10-100 g/kg dry sediment have been found (*ICES, 1993).* The estimated total area in the North Sea of Contaminated seabed ranged from 1900 to 4500 km^2 in 1986 and in 1993 about 8000 km^2 (*ICES, 1993*). The consequences of discharging large quantities of drilling cuttings on to the seabed is bound to have severe environmental consequences in the immediate vicinity of the operation. However, the extent of this effect will be dependent on a variety of factors including the quantity of material discharged, the physical nature of the material discharged, the chemical nature of the material discharged, the depth of water, and the prevailing hydrographic conditions.

3.3 Development Phase

3.3.1 Appraisal Drilling

If quantities of hydrocarbons are discovered then additional wells may be drilled to further define the hydrocarbon reservoir and its production potential. If the field is considered commercial, then some of the future production wells may be predrilled at this stage through a template to reduce the size of the offshore production facilities and the time taken to first production once these have been installed. In principle, drilling these wells is the same as for exploratory drilling, the only difference being that this operation may result in a cluster of wells grouped together.

3.3.2 Design Construction of Facilities and Pipelines

Fabrication and construction of the facilities is generally conducted in a modular form at various construction/ fabrication yards onshore. On completion, the individual modules are loaded onto barges (or in the case of jackets, floated directly) ready for shipment to the offshore location and installation. The design of the installation facilities will involve many decisions with environmental implications.

3.3.3 Installations / Hook-up and Commissioning of Facilities and Pipelines

The installation and hook-up and commissioning is generally phased such that the accommodation is commissioned first, the drilling facilities (if installed) second, and lastly the process facilities. Pipelines are installed separately from the production facilities usually from a pipeline barge. The larger lines tend to be laid on the surface of the sea bed while the smaller ones tend to be buried or trenched. The completed pipeline is then hydrostatically tested prior to receiving hydrocarbons.

3.3.4 Operation of Facilities and Pipelines

The operational life of an offshore installation will begin as systems are commissioned and utilized. If predrilling has not been carried out, the early phases can include drilling either from the facility itself or in some cases from a drilling rig moored alongside. Again, in principle this is the same as described under Exploration except the wells have to be 'completed' for use as producers or injectors. Once the well starts producing it is generally necessary to effectively 'service' the wells from time to time. These 'services' are called 'workovers' and might include activities such as well stimulation, re-perforation or recompletion. Operation of the production facilities will vary depending on the composition of the produced hydrocarbons and characteristics.

Gas platforms in their simplest form often consist of wellheads, a separation train to separate water and condensate from gas, and compressors to transport gas along the pipeline. *Oil and Gas platforms* tend to be more complex with facilities to separate and treat oil, gas and water to ensure that the first two products can be treated and water discharged overboard.

Some fields require the treatment and injection of gas and seawater to maintain the reservoir pressure and others require gas lift to help produce the oil to the surface. The platform is generally powered by generators burning some of the gas produced but with a capability to run on diesel. Small quantities of additional gas are also burned to maintain the pilot in the flare(s) which are needed to burn any relief gas in the event that any of the process plant needs to be depressured either during maintenance programs or in the event of shutdown. During the design phase the process equipment parameters to produce the field in the manner best suited to maximizing the recovery of hydrocarbons will be developed. This will lead to a definition of the necessary support facilities such as power generation, cooling water, ventilation and subsequently the number of people to operate and maintain the plant.

Environmental Impacts

Physical disturbance of the sea bed by oil and gas explorations is largely confined to the area immediately around fixed installations and pipelines. The environmental impacts of an offshore development in its operational phase will fluctuate as the operational parameters change. The potential inputs to the environment from an operational offshore oil & gas installation is indicative of the discharges and emissions that may occur from an installation with drilling operations and processing facilities for oil, water and gas. Principle environmental effects during installation are usually restricted to seabed disturbances. Establishing installations in areas utilized by other sea users, particularly fishermen, can also present concerns. Evaluation of whether the installation causes significant impacts on other sea user is often carried out, particularly for pipeline routing options, in order to assess the potential conflict of interests and where possible take these into account during routing and the need or otherwise to bury or trench the lines (*Grogan, 1992*). *Hook-up, commissioning* and testing of these systems may generate discharges of chemicals, e.g. pickling acids for cleaning pipework and hydrostatic test fluids from pipeline pressure tests. Heavy physical disturbance will simply kill the fauna directly by inundation or by increasing suspended material to levels that prevent normal feeding activity.

Offshore Pipelines

1) Pre-Operational Environmental Impacts

Pipelaying and Trenching - The installation of a pipeline with its related activities will produce various localized effects on the marine environment and its associated biota. These effects are physical disturbance of the sublittoral environment, resuspension of bottom sediments, and burial of the surrounding benthos. Typically, trenching operations are likely to result in increased turbidities for a number of weeks. However, the increased turbidities are likely to be very localized, as dilution occurs rapidly and turbidity will be returned to background levels within 90 m of the operations *(Ikhwani,1995).*

Commissioning - the commissioning of pipelines requires the use of fluids which contain chemicals, e.g. oxygen scavengers, corrosion inhibitors and biocides. After finishing this aspect of the commissioning, the fluids are usually discharged into the surrounding marine environment. The biological impacts will be experienced in a localized area around the point of dispersal, as a result of the direct toxicity of the hydrotest fluids on the pelagic and benthic organisms in that area. Dicks (1982) stated that the extent of this area of impact will be determined by the rate of dilution of the fluids to a non toxic level and the volume of hydrotest fluids released.

2) Operational Environmental Impacts

Such impacts from initial emplacement of a pipeline and the inevitable associated disturbance of the seabed are expected to be localized and short-lived, with an eventual re-establishment of the pre-pipeline environment. The placement of a pipeline in such an area will provide a hard substrate, increase special heterogeneity and thus open a niche for encrusting epibiota. Thus the presence of pipelines encourages the development of a reef like ecosystem in an area from which it would normally be excluded. However, the continuous presence of the pipeline structure in the benthic environment may produce more long term effects including; physical modification of the adjacent sediments and the adjacent benthos, together with a reef effect from the pipeline itself *(Ikhwani,1995).* During pipeline operations, the effects on the marine environment are not only caused by the physical presence of the pipelines, but also by routine operations such as inspection, maintenance and repair. Accidental loss of containment, even when small, can greatly affect the marine environment.

3) Post Operational Environmental Impacts

Cooper (1990) pointed out that the recovering of buried or partially buried pipelines will produce essentially the same disruption of sedimentary habitat experienced when the pipeline was initially trenched and buried *(Ikhwani,1995).* Removal of an exposed pipeline will produce significantly less disruption, however, it will obviously result in the removal of the artificial reef established upon it, and lead to the destruction of any associated benthic communities.

4) The Impacts of Offshore Pipelines on Other Users of the Sea

Clark (1987) and Cooper (1990) reported that particularly in the North Sea, Pipelines have been shown to conflict with the interests of a number of offshore activities. These include shipping, telecommunication and power cables, Ministry of Defense Activities, dredging and dumping, recreation (i.e. diving), and fishing. Additional interference with navigation will be experienced when the pipeline is being laid, repaired or decommissioned. However, these impacts are only temporary and present only minor inconveniences. In contrast, the impacts experienced by the fishing industry are more complex and far more costly if a safety zone (approximately 500m) is imposed over the length of the pipeline. This impact is associated with loss of access to fishing grounds and damage caused to fishing gear and vessels. These problems are accentuated in the North Sea, especially in the British and Norwegian sectors, because of high levels of both fishing and offshore petroleum activities.

3.4 Production Phase

3.4.1 Produced Water

At the average production facility, over 98% of waste is produced water *(Collins, 1994)* from the reservoir. Rising from virtually nothing at the start of production, the volume of produced water can equal that of oil after an average of five years production, but the particular geology of the reservoir is of great importance. (On land produced water is normally re-injected into the ground, but this is rare in offshore fields). The volume of produced water can exceed by ten times the volume of petroleum produced over the economic life of a producing field. During the later stages of production, it is possible to find that 98% of the extracted fluids is produced water and this is not uncommon *(Stephenson,1992)*. For eample, many offshore fields in North Sea (UK sector) are now at the end of their originally planned operational life. As a field ages, it produces more and more water along with the oil at first less than 1% water, but rapidly this rises to typically 4-5 times more water than oil being processed offshore. Some fields are producing even more water possibly remaining viable (under the new PRT regime) with 8-10 times as much water as oil (*Johnston, 1993*).

Components of produced water : Produced Water is a complex mixture of formation/fossil/connate water (the water associated with the oil in the reservoir), injection water (possibly from breakthrough producing wells into the reservoir to maintain pressure and oil production), free oil, low molecular weight acids, very low concentrations of heavy metals and ions, organic matter (hydrophilic compounds, which is made up of as salts of acetic, propionic, and butyric acids), inorganic (such as ammoniacal nitrogen, Hydrogen sulphide) and possibly treating chemicals (i.e. corrosion inhibitor, paraffin inhibitor, biocide, demulsifier, coagulant, flocculent, an-ti foamer, dehydrate inhibitor chemical etc.). The chemical complexity of produced water can a remarkably, and thus its toxicity. In North Sea there is at least a five-fold range in the concentration of low molecular weight aromatics and total soluble organics in produced water from different fields.

Environmental Effects

Winston and Means (1995) reported that " contaminated sediments remain as bioavailable toxic substances even after discharges are suspended. Since some of these foodwebs potentially lead directly to man, there may be both ecological and human health risks associated with in-place, sediment-bound contamination from produced waters." Several studies have indicated that the acute toxic impact of typical produced water is limited to the water column in the immediate vicinity of the discharge caisson provided that the receiving environment is adequately mixed *(Binks,1994).* The main area of uncertainty in produced water toxicity is the chronic or sub-lethal effect of toxic and persistent components such as the heavy metals, multi-ring aromatics, dissolved H_2S and treatment chemicals which may be present in concentrations below their acute toxicity levels.

It is clear that any prediction of the environmental effects of these produced waters must be based upon analysis of their chemical composition. However, these waters are so complex chemically that reliable and complete analyses are few if they exist at all. Many other chemicals are used on production platforms and some proportion of these chemicals will be returned and discharged with the produced water. Clearly the chemical complexity of the water discharged is so great that prediction of its toxicity to the marine environment based upon an incomplete knowledge of its constituents would be of little use.

Field studies of dispersion and experimental studies on toxicity of produced water discharges, suggested that any toxic effects of discharges are likely to be limited to within 1,000 m of discharging installations. Any sublethal toxicity effects on zooplankton and fish larvae due to the aromatic hydrocarbons would be confined within this area. Heavy metal contents are generally thought to be low with no observable effects *(UKOOA, 1986).*

Plankton (Phytoplankton, zooplankton and fish larvae) will all come in direct contact with discharged produced water. Zooplankton appear to be the most vulnerable to produced water, the phytoplankton and fish larvae being more robust to any direct effect. Zooplankton appear to be affected at the egg or very early naupliar stages of development and it has been suggested that the hydrocarbons accumulate in the lipid of the eggs of the copepod zooplankton and that as these lipids become exhausted during the pre-feeding stages the hydrocarbons are 'released' internally in high concentrations, thus causing severe acute effects. In the case of the North Sea, most oily water discharges are directed into the surface water or into the top 30m of the water column, so that any environmental impact is likely to be seen in the plankton of the upper water. However, the evidence from experiments with produced water suggests that the produced water which is presently being discharged in the North Sea will not have a direct toxic effect beyond the immediate vicinity of the platform (*Davies, 1992*).

Sharp and Rogers (1995) reported that the threshold value for the effects of oil in seawater on the planktonic ecosystem is anticipated to be in the range of 0.05-0.1 ppm. Acute mortal effects on fish are observed between 50-100 ppm and eggs and larvae are vulnerable at 0.05 ppm. However, bacterial degradation rates of approximately 0.02 mg/l/day will also reduce the oil concentration in the immediate vicinity of the platform. They also reported that there is no evidence of the accumulation of hydrocarbons from produced water in sediment around existing production sites.

Most chemicals are discharged at concentrations below or at individual species 96 hr LC 50 levels, indicating little or no toxic effect. Dispersion models show that dilution from the discharge point occurs rapidly at some 1000 fold dilution within 50 m of discharge, supporting the assumption that sublethal effects are unlikely beyond this range *(Sharp and Roger,1995).* For H_2S, an Environmental Quality Standard of 10 ppm has been proposed by the EC for discharge into saline waters. The level of H_2S in produced water will be above this objective out to 380 m (10-70 ppm). H_2S may therefore have an impact upon fish and seabed population in a very locallised area.

3.4.2 Particulates

These comprise sand from the reservoir, scales or precipitates which form due to altering chemistry of the produced water, erosion and corrosion debris. They may accumulate in the process and then be periodically removed and discharged as part of the routine maintenance activities. Some particulates are discharged within produced water.

3.4.3 Drainage

Deck drainage can be defined as all water (salt and fresh) resulting from precipitation, deck washings, tank and equipment operations, including drip pans and work areas. The content and volume of drainage is determined by drainage area type and size, exposure to natural precipitation, frequency and duration of fire prevention operations, detergents / solvents used in deck and equipment washdowns and exposure to oils and chemicals from processing and drilling equipment.

3.4.4 Cooling Water

The effect from thermal pollution results from the discharge of cooling water is not necessarily deleterious, the localized warming encouraging fish although it may enhance growth of fouling organisms.

3.4.5 Sewage and Domestic Waste

Assuming a total working population on platforms and drilling rigs offshore at any given time of about twelve thousand, the sewage inputs can be calculated as approximately 500 tones dry weight per year and kitchen waste at about the same. Combined, this will exert a demand of some 500-1,000 tones oxygen per year. For a typical large production platform some 10-15 tones waste could be discharged per year *(Somerville, unknown year).* These inputs depend almost directly on working population. Significant quantities of sewage are also discharged amounting to approximately 2 million m^3 per year, about 0.07 % of the total annual input of the North Sea *(Kingston, unknown year).*

Environmental Effects

Principle effects from sewage and domestic waste inputs from offshore installation result in local oxygen demands and nutrient enrichment, which has effects for the biological communities with low numbers of species, but huge numbers of individuals.

3.4.6 Litter / Garbage Waste

Litter from offshore installations is compacted and returned to shore for disposal. Garbage wastes includes kitchen and food waste, and general garbage. Food is dumped directly overboard, after fulfilling certain requirements.

3.4.7 Oil Tankers - Ballasting Discharges

On conventional oil tankers the same tanks are used for water when in ballast and for cargo when loaded. The disadvantage with this is that oily waste is discharged with ballast water thus threatening pollution. On the voyage oil-contaminated ballast water will normally be discharged into the sea through a separating system with any oily residues kept in slop tanks. Ballast will be discharged nearer the loading port to achieve the right trim for berthing and to keep down the amount handled in port. However, over the last 10 years or more there have been major changes in tanker design and operation, Newer tankers with segregated ballast spaces have only a very limited need to put ballast in their cargo tankers. But older crude oil tankers operating with crude oil washing systems (and older product tankers) do clean, decant and change their ballast. Inevitably some oil remains in the discharge.

Environmental Effects

Other pollution problems from ballast water discharge include pathogens and harmful alien organisms in apparently clean ballast water: this applies to all vessels, including oil tankers, taking on ballast for long journeys. In addition, some of the fine particulate material taken in with the ballast water settles out during the voyage as a sediment. A diversity of living organisms has been found in mud samples taken from the bottom of ballast tanks (*HMSO, 1994*).

Ballast water can be contaminated by imported organisms. They may cause no difficulties on short vovages because similarities in marine communities, but on longer vovages, or on those between significantly different ecosystems, the introduction of alien species is of major concern. Hundreds of species of plants and animals have been recorded in ballast water and there are many well-documented examples of alarming alterations of marine food webs by such introductions in different parts of the world. The invasion of the Asian clam in San Francisco Bay, of the zebra mussel in the Laurentian Great Lakes, and the comb jelly fish in the Black Sea are among the most dramatic illustrations of the catastrophic impact of ballast water introductions (*HMSO, 1994).*

3.4.8 Atmospheric Emissions

1) Sources of Emissions

The principle sources of atmospheric emissions from installations are flaring, venting, exhausts, fugitive emissions, and the release of halons and CFCs. The main types of gaseous emissions from offshore installations are carbon dioxide, carbon monoxide, nitrogen oxides, nitrous oxide, methane, volatile organic compounds, halon, hydrogen sulphide, sulphur dioxide.

a) Flaring

Flaring occurs only on oil production platforms and is not practiced for safety reasons on gas production platforms. Typical sources of gas sent to flare are purge gas, blowdown valves discharge, pressure relief valves discharges, flash gas from produced water and glycol regeneration systems, and flash gas from separators in excess of fuel gas needs (where gas is not reinjected or sold). During normal operations, minor upset conditions may result in short controlled discharges of gas to the process flare.

Oil enters the sea from flaring. This takes place during well testing and can result in unburnt hydrocarbons being released. The possible contribution of flaring to oil contamination has not been quantified; however, recent studies show that a typical well lost as much as 30% of the hydrocarbons being flared as they remain unburnt . Danish observations have shown that, owing to incomplete combustion, flaring may lead to visible oil contamination (indicating a concentration of at least 40 mg/l oil at the water surface) (*ICES, 1993*).

b) Venting

Vents on production platforms may serve high or low pressure equipment and controlled venting occurs on most installations. Typical sources of vent gas are maintenance vents, produced water system, blanket gas, and glycol regeneration / deoxygenation of seawater.

c) Halons and Chlorafluorcarbons (CFCs)

CFCs and HCFCs are used in process refrigeration, air conditioning, and domestic freezers and refrigerators. Losses occur from leaks and during the replacement of the refrigerant in process systems. Halons are used in fixed and portable firefighting equipment. This is only discharged when necessary and sometimes through malfunction or during maintenance of the equipment or detection systems.

d) VOC Releases

On a global scale, considerable concern has been expressed regarding the atmospheric impact of the emission of volatile organic compounds (VOCs). International convention pressures are requiring contracting parties (as yet not the UK) to reduce VOC emissions considerably, to 30% of 1988 levels by 1999. There are several sources of VOC release from the operations, including : unburnt HC in flares, turbine exhaust, process venting, fugitives, and tanker loading.

Environmental Effects

The gases of particular interest are CO_2, Methane, VOCs and NOx emission because of their role in global warming as greenhouse gases. With pressures the UN Protocol on Climate change (1992), targets have been set of reducing CO_2 emissions to 1990 levels by the year 2000. The European Community, in concert with many countries, is considering the imposition of a carbon or energy tax to reduce such emissions. In addition, CFCs and Halons discharges are of interest because their role in ozone depletion*(CEMP(4),1996).* NOx and SOx emission also are interset because their role in acid rain *(CEMP(1),1996).* However, as a result of the Montreal Protocol, phase-out of these latter substances is at an advanced stage.

3.5 Decommissioning and Abandonment

There are four main options currently available ranging from leaving structure in place, partial removal through to whole removal. The parts removed can either be toppled in situ, dumped in deeper waters or taken onshore for scrapping. This applies to platforms, pipelines and other subsea installations. While it can be extremely costly to remove installations and structures once their active life has finished, if they remain in situ they can represent a significant source of damage to marine environment, either through release of toxic substances which cause damage to fish stocks or pollution of the seabed from remaining debris *(CEMP,1994).* This is a serious problem which will increase over time as oil & gas fields are exhausted. Environmental implications will depend on the form of removal.

Environmental Impacts

The most significant acute environmental effects of actual decommissioning operations is likely to arise from using explosives cutting charges in the dismantling of the steel jacket. All marine organisms can potentially suffer injury from exposure to an explosive blast inevitably focuses on fish (including sensitive larval stages), mammals and birds. In the case of North Sea, Side and Davies (1989) calculated for a 2.5 tones (TNT equivalent) charge in the North Sea an estimated mean fish kill of 20 tones of fish with a 0.95 probability that the fish kill is less than 125 tones (*Side, 1992*). While the likely fish kill from explosive cutting activities will thus be very small in relation to the total North Sea fish stocks significant uncertainty surrounds the effect on larval and juvenile stages. For very small fish the observed lethal impulse is much lower and the corresponding lethal range predicted by the various available models is much greater. Birds and mammals may also suffer injury from underwater blasts. Birds in the air at the time of explosion are unlikely to be affected to any significant extent and as with oil spills those species most at risk are those which are likely to be on or in the water.

The other effect is residual contamination of the sea bed, for example from drilling cuttings and low special activity (LSA) scale; contaminated structures, process members and pipework such as LSA scale; interference with navigation and fishing activities, for example from remaining structure below navigable depth, unrecovered debris and abandoned pipelines.

Summary

The primary wastewater sources from the exploration and development phases of the offshore oil & gas extraction industry include drilling fluids, drill cuttings, sanitary wastes, deck drainage and domestic wastes. Drilling fluids (muds) and drill cuttings are the most significant waste streams from exploratory and development operations in term both of volume and toxic pollutants. The primary wastewater sources from the production phase of the industry include produced water, produced sand, sanitary wastes, deck drainage, domestic wastes, well treatment, completion and workover fluids. Produced water is the largest waste stream from production activities based on its volume of discharge and quantity of pollutants. Deck drainage, sanitary wastes, domestic, produced sand, and well treatment, completion, and workover fluids are often classified under the term miscellaneous wastes. Every phase of oil & gas activities can affect the environment. In case of offshore the effects is summaried in Table 3 -1.

PHASE	ACTIVITY	ENVIRONMENTAL PARAMETERS
Exploration	Seismic	• Commercial fisheries • Seabirds at sea • Sea mammals • Other sea usersmaritime activities (MoD, amenity, pipelines, cables, commercial navigation etc.)
	Drilling	• Disturbance to seabed • Physical presence • Operational discharges (drill cuttings, drilling fluids) • Accidental spillages (oil spill)
	Wellhead Suspension or Abandonment	• Fisheries interactions • Other sea users
Development	Appraisal Drilling	• Disturbance to seabed • Physical presence • Operational discharges (drill cuttings, drilling fluids) • Accidental spillages (oil spill)
	Installation	• Physical disturbance • Other sea users • Discharges
	Hook-Up and Commissioning	• Physical disturbance • Construction/commissioning discharges • Fisheries interaction (installation and pipelines)
Production	Operations	• Operational discharges (e.g. drill cuttings) • Accidental spillages • Physical presence • Fisheries interaction • Other sea users
Abandonment	Decommissioning	• Discharge/wastes from decommissioning • Physical presence[a] • Fisheries interaction • Other sea users • Method of abandonment • Long term requirements/post decommissioning (e.g. monitoring)

a: depends on method of abandonment

Table 3-1 Oil and Gas Actiivities affect Environmental Parameters ***(CEMP(3),1996)***

General impacts from E&P activities which can affect to the environment such as seismic disturbance of fish breeding and hatching, conflict with other sea users, e.g. fishing, navigation, naval uses etc. other impacts include, disturbance of benthic and coastal ecosystems, mortality and/or reduced reproduction of marine life, disturbance of marine mammals, groundwater contamination, oily water discharges, degraded air quality, oil spills impacting sensitive coastal areas: mangroves, corals, national parks, tourist/recreation areas, visual impact, local disturbance of seabed from discharged cuttings, elevation of background pollutant levels, impacts from decommissioning and abandonment, onshore impacts from decommissioning and abandonment, socio-economic impacts and conflicts.

Section 4

ENVIRONMENTAL MANAGEMENT REVIEW

4.1 Introduction

The aim of this Section is to overview existing current knowledge about general worldwide environmental management. Major elements of environmental policy, new approaches to environmental compliance enforcement framework, the World Bank's environmental strategies, and environmental management techniques are concentrated on here as guidelines for oil & gas activities in Thailand are discussed specifically in the Section 9.

4.2 The Major Elements Of An Environmental Policy

The evolution of a framework for environmental protection follows four stages : acceptance of the problem, policy development, proposal of solutions, policy implementation *(UNEP, 1992).* Stages two to four can be seen as a cycle :

The Regulatory Cycle

Set Legislation, Standards, Approaches	⇒	*Develop Permitting System*
⇓		⇓
Enforcement of Compliance	⇐	Implementation (inc. monitoring)

Each element needs to be continuously evaluated. Stages two to four are usually the 'weak links' in the chain *(UNEP, 1992).* Compliance information is of four types:

1. self-monitoring and reporting by the polluter
2. inspections by government officers or third parties (e.g. independent audits)
3. complaints from the public
4. ambient ('background') monitoring

An approach that is integrated ensures that pollution is not transferred from one media to another.

4.2.1 Permitting

An environmental permit should be a legal prerequisite for the company to operate. The permitting policy must address the following questions:

1. Who should be required to have a permit?
2. Which government body should receive the permit application?
3. Which government body should monitor and enforce the permit?
4. By what process will the permit be decided upon?
5. What elements should a permit include?

Permitting Procedure [no.4]

There are generally five stages:

1. planning, submission of application,
2. examination of application,
3. issue of permit,
4. notification of permit to applicant,
5. publication of permit.

(Source : UNEP, 1992)

Elements of the Permit

1. General
   - company policy
   - plant description
   - process description
   - prevention measures
   - implementation schedule
   - response plan
   - future developments
2. EIA and Risk Assessment
   - EIA : the core of the application
   - risks
3. Emissions
   - Emission types and levels
   - treatment and disposal measures

4. Management Plan

- monitoring measures
- reporting measures
- responsible officer

4.2.2 Inspections

There are three main areas for checking :

1. Pre-visit administrative checks - e.g. of the inspectorate's records
2. On-site administrative checks - e.g. of the facility's monitoring records
3. On-site inspections - e.g. visual checks, samples.
4. Compliance report - on the inspection's findings
5. Feedback and Follow-up

Initial inspections are most effective un-announced, but for good performers advance notice can be given. The enforcing inspectorate should be independent of the agency issuing the permit, and of the industry in question *(UNEP, 1992).* This allows the inspectorate to act as the 'conscience' of government, maximizes objectivity, and can reduce risks of corruption.

Tasks of an Environmental Inspectorate

Tasks vary depending on the stage of economic and environmental development

Situation	Function of Inspectorate
1. Very few laws, no enforceable permits or permitting office	Advice, planning, assistance, not policing
2. Some laws, permits developing,more enforceable prescriptions	Less advisory, very strict, but still not a policeman, assistance only on request, more consistent in action
3. Licensing procedures running, more laws, standards known.	Acts like policeman if necessary. Requires reports, actions, results. Gives strong warnings.
4. Enforcement now required	Compliance testing, emissions checks, accountant checks on work books

(Source: *Adapted from UNEP, 1992)*

Key Tasks

1. Advice for permit applicants and communication with permitting authority
2. Assisting with development of permit content
3. Advising and assisting the operator to comply
4. Enforcing when necessary, defining and imposing remedial actions, application of sanctions
5. Follow-up on results of inspection monitoring
6. Keeping of records and inventories
7. Preparation and dissemination of regulatory and technical information for operators
8. Keeping the public well informed about the environmental situation
9. Promotion of sound environmental management practices.

Resources Required For Developing An Inspectorate

1. trained staff to conduct integrated (multi-media) inspection
2. infrastructure with administrative and criminal prosecuting authorities
3. sampling equipment
4. support equipment and systems
5. certified laboratories for analysis
6. specialized personnel for direct sampling

(NB: DMR Site Officers will need environmental training and must be incorporated into the Environmental Inspectorate's roles and organization etc.)

4.3 The World Bank Environmental Strategies

There are five steps towards improved environmental management as follow;

1. Priority Setting
2. Use of Cost-Effective Policy Instruments
3. Strengthened Institutional Capacity
4. Increased Public and Private Sector Investments

5. Improving Technology *(Adapted from Brandon C and Ramankutty R, World Bank papers, 1993)*

4.3.1 Priority Setting

This is both essential and very difficult, especially for developing countries (*World Bank, 1993*). There are so many potential actions, and so many constraints, that it is vital to know what is: most urgent and most important. Data are often insufficient for a full cost-benefit analysis. The most effective way to set priorities is to consider all the following inputs : technical, public, scientific, economic, and medical. Key decisions for regulators:

1. what level of environmental quality is acceptable?
2. what instruments should be employed to realize these quality objectives?

4.3.2 Use of Cost-Effective Policy Instruments

Economic Effects of Environmental Regulations : Cost impacts are not always incorporated into regulation-setting. An extensive system of environmental regulations would very probably have negative impact on E&P activity *(Godec and Biglarbigi, 1991)*, in addition to being impossible for the institutional framework of a developing country to take on *(Snidvongs, 1995)*. The economic effects include : substantial decrease in recoverable reserves; accelerated abandonment of fields. An environmentally appropriate policy is one that continues to foster economic activity, but acts to correct the bias caused by market and/or policy failure that cause over-use and/or under-pricing of environmental resources. There are three main types of environmentally sustainable policy:

- market-based policies e.g. permits, charges, pricing;
- regulatory policies- the 'traditional' command-and-control approach;
- extra-regulatory approaches, e.g. liability suits, public disclosure.

Regulatory controls suffer from relatively low economic efficiency, together with relatively high usage of scarce administration skills in countries. ***The program should have "win-win" approaches with economic as well as environmental benefits.*** (*World Bank, 1993*).

Market - Based (Economic Instruments-EIs) Policies

Fundamental to reduction in resource usage is *full-cost pricing.* This is pricing free of subsidies and also with internalized externalities (external costs). This can be achieved with taxes, charges, or permits. Strong dis-incentives, as well as mild, time-bound, fiscal incentives, should be used (*World Bank, 1993).* Examples of each are given below:

Disincentives	Incentives
1. pollution charges	1. temporary subsidies
2. permits	2. accelerated depreciation
3. presumptive charges	3. lower customs duties

Regulatory Policies

On the one hand, a host government needs the regulatory powers to control production for the benefit of better environmental management, e.g. with minimal gas flaring. On the other hand there is the need to maximize the overall technical and financial efficiency of the operation. There are four main types of regulatory systems regarding the environment (*UNCTC, 1982*):

a) ***Permits or licenses*** - these may include operating conditions, e.g. limits on amounts of waste produced. Violation of conditions may result in suspension of all activity;

b) ***Reporting and impact assessment systems*** - involving the submission of detailed information about environmental impacts prior to operations. This approach was pioneered by the United States and Canada;

c) ***Prohibitory Statutes***- controlling certain activities, with violations resulting in fines. The United Kingdom has historically relied on this type of system;

d) ***Contractual clauses***- traditionally many developing countries have limited their environmental requirements to specific brief clauses in the development contract.

Generally, there is often more overlap in the above areas in industrialized countries than in developing ones, where arrangements tend to be less complex. More important than this is the quality of enforcement by government agencies. Weak enforcement is the Achilles heel of effective regulation, and can be directly associated with poor environmental management in many developing countries. Availability of sufficient skilled manpower is essential.

Host countries must always balance their contractual restrictions on operators, including those relating to the environment, with the danger that restrictions seen as overly stringent may deter some potential developers (*UNCTC, 1982*). Many governments reserve the right to intervene directly to stop pollution, e.g. by requiring the operator to cease the polluting activity within a certain period, and/or reimburse the government for any response costs incurred. Many developing countries require security bonds for covering the costs of pollution clean-up activities. Accident contingency plans, at the company and industry levels, are also commonly required. Many developing countries have used the following strategies to set regulations (*UNCTC,1982*):

a) a full and detailed set of regulations taken en masse from an industrialized country as a model for good management;
b) specific ad hoc directives issued by relevant government agencies;
c) industry standards and guidelines, e.g. from the American Petroleum Institute, E&P Forum;
d) international standards, e.g. from organizations such as the World Bank.

Extra-Regulatory Approaches

Public participation through public environmental performance disclosure/reporting and civil (private) law liability are cheap and effective for point-source pollution, but have not been much introduced in the region (*World Bank, 1993).* (Thailand is a possible exception).

4.3.3 Strengthened Institutional Capacity

Sufficient institutional capacity must be in place to allow policy to be effectively enacted. A typically weak institution lacks technical skills, political power, management information and resources. The World Bank (1993) states that many Asian nations have environmental legislation, but do not commit to building effective institutions. It also warns that decentralization (as in Thailand) is potentially a threat to effectiveness, and that there are few successful case studies so far. The fundamental catalyst for effective institutions is a long-term commitment from government.

World Bank Best Practices for Strengthening Institutions

a) Measures for Technical improvement

- strengthening ability for national regulatory agencies to set policies and standards
- encouraging finance and planning ministries to align market policies with sustainable development

b) Measures for Effectiveness of Technical improvement

- Sharpen the institution's focus towards key goals which fit overall national policy
- Recruit only technically qualified personnel
- Provide sufficient incentives to discourage corruption

(*World Bank, 1993*).

Building Institutional Capability

For the regulatory agency to maintain credibility, laws should be applied fairly, systematically, and effectively. In addition, it is best for a government to encourage, as far as possible, companies to establish their own EMSs, and to maximize voluntary compliance and self-regulation, and peer pressure and public involvement are also important mechanisms in this regard *(UNEP, 1992).* There is often a time-lag between the establishment of permitting, and establishment of effective enforcement systems (UNEP, 1992). The permitting and enforcement should be multi-media and integrated, and will require continuous evaluation and modification.

4.3.4 Increased Public and Private Sector Investments

An important issue is the degree to which these investments can be made financially viable- e.g. waste minimisation, energy conservation, reduction, re-cycling, re-use. Also, important is the extent to which these measures can be made self-financing.

4.3.5 Improving Technology

There could include clean technologies e.g. which combine higher efficiencies (energy input: energy output) with less waste.

4.4 New Approaches To Environmental Policy Framework

Firms in developing countries have historically faced very few legal restrictions on there freedom to damage the environment. Economically speaking, the environment was treated as a free public good, of infinite supply. There are increasing moves away from the traditional ***'pollutee pays'*** situation, towards a ***'polluter pays' system.***

4.4.1 The polluter pays principle

The idea here is that the polluting organization or facility should shoulder the environmental costs of its damage, and of its repair. As a result, control measures can be made self-financing. These costs may be mitigative or preventative, the latter being generally the lower. These costs are, obviously, passed on to the consumer as higher prices. The extent to which this affects demand for the product in question is a function of the product's price-elasticity of demand. Demand for energy sources, including hydrocarbons, is highly inelastic, implying that relatively high costs can be incorporated into the selling price with relatively little effect on demand.

4.4.2 Defining the pollution policy framework

Securing sufficient political will to effectively address pollution is often made more difficult by the ability of major polluters to present a very powerful lobby to national government. In many developing countries this situation is only brought into balance with the gradual development of public environmental awareness and concern, typically from expanding middle classes, which presents a counter-lobby. Thailand still has a long way to go in this respect, and so it is probable that any proposed changes to the environmental management system can only be introduced with the active co-operation of the industry.

Governments in developing countries are typically unable to field the necessary financial, technical, and human expertise in environmental management. For this reason it is often advisable to act in co-operation with industry. This partnership can occur at many stages:

- at the earliest stages a consensus of opinion must be established within the business community that stronger environmental management is needed.
- industry should be consulted on the extent to which strict regulatory ***Command and Control (CAC)*** and ***Economic Instruments (EIs)*** are applicable.
- the industry can give technical advice to government in the drafting of standards- much better than copying standards from other countries.

4.4.3 Criticisms of CAC approaches

The traditional approach in developed countries has been regulatory- 'command and control' measures. These are driven by an overriding concern for public heath, and the belief that the government should (and can) set maximum permitted human exposure standards. These ambient standards are then translated into:

- prescribed uniform emission standards
- prescribed specifications for pollution control technologies- this is particularly inflexible and inefficient

Another criticism of CAC approaches is the high administration costs- to both government and industry. Complex and detailed prescriptive regulations require a large staff of highly qualified people, which most governments cannot provide. As a result, all that is left is a long list of regulations that are ineffectively enforced- a 'paper tiger'. CAC methods can also rely too much on the discretion of the regulatory enforcers, who if low-paid, may well be overly susceptible to informal financial inducements. Economic (or 'market-based') instruments are not necessarily the cheapest way to achieve environmental management aims, however. This must be decided on a case-by-case basis.

For EI's to work most effectively, the basic preconditions of an efficient market should be in place- mainly clearly defined property rights and legally enforceable contracts. Thus pollution charges/ taxes work well in existing markets, whereas in other cases market efficiency can be increased by tradable permits. The number of possible market-based instruments is theoretically limitless. The only commonly used measures which may be applicable to E&P include:

a) Emission Charges/ Taxes

These are levied on the quantity and/or quality of emissions. Charges can be introduced gradually, giving industry time to make appropriate adjustments to production processes, and giving government time to 'fine-tune' the system so that the price signals provided are optimized for meeting the environmental objectives. Charges best suit:

- stationary sources of pollution, where there are:
- a variation in marginal pollution abatement between the facilities/operators,
- emissions monitoring is feasible,
- short-term changes in the polluters' behavior,
- long-term technological innovations are possible.

b) Tradable Permits

An overall acceptable level of emissions is set for the whole industry, for each environmental media (i.e. air, water, land). Equivalent permits are then allocated to emitters. Tradable permits can substantially reduce pollution control costs, compared to CAC measures. Permits can be introduced where there are:

- binding ambient quality standards
- overall target emission levels
- differences in marginal compliance costs between target groups
- a number of sources that is sufficient to establish a well functioning market
- impacts that occur relatively soon after pollutants are released
- potential for technological innovation

4.4.4 Potential for Hybrid CAC / EI Systems

Economic Instruments (EI) are best viewed as possible complements to existing Command and Control (CAC) approaches, rather than alternatives. Few EI's are not linked to regulations *(ESCAP,unknown year)*. Ambient quality levels are required in order to measure the effectiveness of the EI's, and thus allow them to be appropriately 'tuned'. Ultimately, though, with some EI's there is an important element of uncertainty as to whether the indirect approach of effected price adjustments can bring ambient levels to meet the desired targets. Such uncertainty is minimized with tradable permits, but government must still monitor the quantities being emitted, to ensure that they do not exceed the permit's specification. For this reason tradable permits can often be more expensive to operate than a CAC approach. The CAC element is intended to minimize regulatory uncertainty, the EI element is intended to allow firms the maximum flexibility to meet the required performance levels.

4.4.5 Technological Innovation

Innovation in environmental technology will only become a mainstream concern for firms when it has become financially rewarding to develop such ideas. Governments should aim to create an incentive structure that ensures this financial reward. Another consideration is the inertia resulting from innovation typically following a well-defined trajectory. Changes in direction, therefore, may take time to be consolidated. Many environmental improvements are possible with existing technology, but are not undertaken because of lack of commercial incentives. According to an estimate by the US Office of Technology Assessment, approximately half of the US's industry's hazardous waste could be eliminated by application of current technologies *(ESCAP, unknow year).* Tax incentives can aid the importation and diffusion of new, cleaner technologies.

4.4.6 Implications for Policy Directions

Set environmental priorities : Environmental risk Assessment and cost-benefit analysis can be used to help allocate scarce government resources to the most important areas. Offshore E&P is unlikely to be high on Thailand's list, when there are so many other environmental concerns of more direct impact on people's lives.

Define environmental standards : Decisions must be made as to what are the desired ambient quality levels.

1. Build co-operative relationships with industry. Consultations with industry are needed in order to establish standards that are feasible. Economic incentives should be structured to not pollute.
2. Make the polluter pay.
3. Encourage prevention before abatement
4. Aim for zero emissions.
5. Find the best balance between CAC and EI's
6. Encourage innovation and diffusion of clean technologies.

(adapted from ESCAP, unknow year)

4.4.7 Market-Based (Economic) Instruments

a) Potential Advantages

- Cost-effectiveness
- Flexibility
- Incentive to Improve and Innovate
- Transparency
- Adaptability
- Multiple Objectives
- Administrative Burden
- Easier Market Entry

b) Concerns

- Use of EI as generators of government revenue
- Little practical experience to date
- Vulnerable to Market Imperfections (especially in developing countries)

Hinton (1995) mentioned that **'the regulatory habit can rapidly grow beyond reason, with increasingly stringent and costly controls that damage the economy and too often do little to protect the environment.'** In the light of the above situation, it was recommended that newly evolving regulatory systems should be based on 'sound science' and cost-benefit analysis. It is essential to maintain a balance between the three E's: Energy, Economy, and Environment. The recommended approach was based on three steps:

1. Identification of specific environmental risks
2. Application of sound scientific principles
3. Use of cost-benefit analysis to compare proposed regulatory measures

4.4.8 Compliance and Enforcement Programs :

Agenda 21

An international mandate for the building of compliance and enforcement capacity was established by the United Nations Conference on the Environment and Development (UNCED), in its outline of aims, Agenda 21, in Chapter 8, Section (e), 8.21. This called for the:

> (e) Develop effective national programs for reviewing and enforcing compliance with national, state, provincial and local laws on environment and development.
>
> 8.21. Each country should develop integrated strategies to maximize compliance with its laws and regulations relating to sustainable development. The strategies could include:
>
> (a) Enforceable, effective laws, regulations and standards that are based on sound economic, social and environmental principles and appropriate risk assessment, incorporating sanctions designed to punish violations, obtain redress, and deter future violations;
>
> (b) Mechanisms for promoting compliance;
>
> (c) Institutional capacity for collecting compliance data, regularly reviewing compliance, detecting violations, establishing enforcement priorities, undertaking effective enforcement, and conducting periodic evaluations of the effectiveness of compliance and enforcement programs;
>
> (d) Mechanisms for appropriate involvement of individuals and groups in the development and enforcement of laws and regulations on environment and development.

Effective deterrence is vital. It is the creation of an atmosphere in which the vast majority of operators choose compliance over violation of the law. This situation requires:

1. credible probability that any non-compliance will be detected;
2. rapid and unambiguous response by the relevant government agency;

3. appropriate consequences, as sanctions or penalties;
4. general perception that all the above conditions exist.

Wasserman (1994) offers a general framework for compliance and enforcement. This framework is based on the following elements:

1. **Creation of requirements which are enforceable.**

   Appropriate linkages between relevant agencies are important.

2. **Clear definition of who is subject to the requirements, and prioritization.**

   Useful information for the establishment of the program could include:

   - emissions quality and quantities
   - quantitative risk assessments
   - compliance status and schedules

3. **Promotion of compliance.**

   Policy makers must decide the most effective and efficient mixture of promotion and compliance response. Enforcement alone is often not as effective as enforcement with promotion as well. Compliance promotion includes:

   - providing education and technical assistance to the regulated community
   - building public support
   - building capability for environmental management in the regulated community
   - publicizing success stories

4. **Monitoring of compliance.**

   Sources of compliance information include:

   - EIA
   - Inspections by enforcers
   - Self-monitoring by the operators
   - Audits
   - Public (including pressure groups and NGOs) complaints
   - Environmental effects monitoring

Inspections are the backbone of the program, but are resource-intensive, and therefore must be planned and targeted.

- Standardization of procedures, for equal treatment of facilities
- selection of facilities for inspection
- legal authority of inspectors- access to site, information etc.
- roles of inspector- immediate judgments, technical assistance etc.
- comprehensiveness of inspections- to include sampling or not
- ensuring the objectivity of the inspector
- documentation of violations
- training of inspectors
- management of data quality
- consistency of sampling and analytical procedures
- equipment required

5. *Response to violations.*

Enforcement responses can serve to:

- add credibility to compliance programmes by ensuring consequences
- return violators to compliance
- impose a sanction
- *remove the economic benefit of non-compliance*
- correct internal company management inadequacies
- correct or redress actual or potential harm
- negotiation can be useful in addressing operators' concerns.

6. Clear roles and responsibilities.

Key issues include:

- demarcation of responsibility- both vertically and horizontally
- separate programs for each media or full integration
- degree of public involvement

7. Evaluation of the program's success.

Measures of success include:

- environmental results

- compliance rates
- progress in returning violators to compliance
- measures of compliance monitoring
- number of enforcement responses
- timeliness of enforcement responses
- measures of technical assistance

Data management considerations are of great importance, and include accuracy, responsibility, frequency, documentation and reporting etc. Proper functioning of compliance and enforcement programs requires consideration of many factors, including the following *(Wasserman, 1994):*

- Organization and personnel roles, staffing levels, training, and use of third parties;
- Information management systems, and planning
- Program funding
- Program commencement and evolution
- Permitting processes

Factors Affecting Compliance

Incentives to Compliance	Barriers and Disincentives to Compliance
1. Economic Desire to avoid a penalty Desire to avoid future liability Desire to achieve short-term advantage Desire to reduce wastage/ inefficiency	 *Lack of funds* *Competing demands for resources* *Greed*
2. Social Social values for environmental quality Societal respect for the law Clear government will to enforce laws	 *Lack of societal respect for the law* *Lack of public support for environment* *Lack of government will to enforce laws*
3. Personal Positive personal relationship with enforcers Desire to avoid legal process Desire to avoid adverse publicity, conviction	 *Fear of Change* *Inertia* *Ignorance of requirements* *Ignorance of how to meet requirements*
4. Management Jobs and training for compliance Financial incentives for compliance	 *Lack of accountability for compliance* *Lack of management systems for compliance*
5. Technological Availability of affordable techniques	 *Technological inability to meet requirements* *Unreliable or difficult techniques*

(Adapted from: Wasserman, 1994)

4.4.9 CEPs : Institution

Experience has indicated that compliance and enforcement are frequently the major areas of weakness in an environmental management program (UNEP, 1995). Major institutional problem areas with CEPs (compliance and enforcement programs):

- unclear definition of objectives
- inadequate links among functions and elements of the program
- incompatibility between the program's requirements and its capacity to implement
- unclear definition of roles, powers, and responsibilities
- failure to adequately promote voluntary compliance

Fundamental questions in implementation of a CEP:

- what mandate and objectives?
- what are the appropriate functions?
- what are the institutional and organizational options?
- what factors affect these options?

Enforcement must be rapid, effective, consistent, and highly visible (UNEP).

The Main Institutional Functions of a CEP

1. Program Development Functions
   - establishing a regulatory and policy framework and procedures
   - establishing and implementing a permitting system
   - establishing and implementing a compliance monitoring and inspection system
   - establishing cases against violators, and initiating enforcement actions
2. Planning and Evaluation Functions
   - planning and evaluation
   - capability building
   - information management
3. Support Functions
   - education and public outreach
   - public and private dialogue

- technical assistance

All these functions must be embodied and integrated within the CEP.

Potential Imbalances among Program Functions:

- Too much emphasis on developing laws, and not enough on implementing and enforcing them
- Inconsistent enforcement
- Lack of incentives to promote voluntary compliance
- Incompatibility between requirements and permits
- lack of tools for inspections and monitoring

Important Areas in the Design Process

- the long-term strategy should be based on both incentives towards compliance, and sanctions against violations
- the requirements of the CEP should be compatible with the program's resources
- more complex and more numerous requirements can be phased in after the most important and simple ones
- permits should be strongly emphasized
- monitoring and inspection activities should be harmonized with permitting
- sufficient emphasis should be placed on education and public outreach

Advantages of Integrated CEPs:

- no transferring of problems from one media to another
- more efficient use of resources by both government and industry
- simplified permitting and compliance processes
- monitoring assesses the total environmental effect of the facility

Inter-agency Co-ordination

- makes the best use of limited resources

This can be considered in the following situations:

- where inter-agency communication is already well-established and is effective
- where other agencies have the resources required
- where the nature of the work allows effective co-ordination

The main obstacles to effective CEPs are:

- too many organizations involved, often with overlap and duplication of responsibility
- inadequate interaction between enforcing agencies and other public and private bodies

Some Responsibilities of Enforcing Agencies

- registering facilities, reviewing EISs, reviewing permit applications, permit writing and issuance, certificates of operation and compliance, establishing links with monitoring and inspection functions
- developing and disseminating documents for guidance and training
- providing technical assistance and advice
- providing response and comment to other sections of the agency
- reviewing compliance self- monitoring reports
- conducting inspections, reviewing records, and establishing cases of non-compliance
- follow-up of non-compliance cases, leasing with judicial authorities, conducting negotiations and conflict-resolution
- developing contingency plans for emergency response and corrective action
- public outreach
- information management
- pre-service and in-service training
- Must get opinions and support from the regulated community, and also the public (inc. NGOs).

(adapted from UNEP, 1995)

Can increase CEP efficiency by:

- setting up a system to rigorously prioritize the issues [by 1/ importance, and 2/ urgency] and the allocation of resources
- implementing the CEP in phases, in order to balance resources with priorities

Initiating the CEP

- inventorying the actual, probable, and possible environmental issues
- revising laws, standards, and regulations
- setting goals, performance targets, and general strategy
- setting operational priorities for the agency
- establishing schedules for compliance self-monitoring and reporting
- define the roles of inspectors
- develop and implement effective responses in the first phase
- start with the environmental issues of highest priority- e.g. those with implications for public health and safety, operational integrity, national laws and international treaties

Expanding and Improving the CEP

- make all the functions of the CEP strategy fully operational
- re-evaluate the CEP's priorities
- develop more stringent requirements if necessary
- increase focus on management of hazardous waste

Increasing the CEP's Effectiveness and Efficiency

- Enforceability of requirements
- Flexibility to allow adaptation to future changes in political, institutional and industrial factors

Resource Requirements

1. ***staff***

   - program functions
   - planning and evaluation
   - support functions

Required Staff Categories:

- managerial
- political and regulatory
- environmental quality
- permit writers and inspectors
- information management
- support

2. ***capital***

   - laboratories
   - field sampling equipment
   - office space
   - computers
   - libraries

3. ***operational***

   - office supplies and publications
   - laboratory materials
   - *equipment maintenance*
   - funds for contractor support

Resource needs must be balanced against the CEP's goals and aims, which may need to be revised in order to fit the resources made available.

Factors to determine Staff Requirements for Permitting and Inspection

- desired ratio of inspectors to facilities
- desired ratio of permit writers to facilities and operational processes

- scope and number of requirements
- required administration and management support

Ways to increase Resource-use Efficiency

- assess existing capabilities
- provide financial incentives to the regulated community
- use promotional measures
- prioritize resource allocation
- maximize effectiveness from resources

Compliance Self-monitoring

- saves time and money for regulatory agency
- gives operators advance warning to put problems right
- can only work if there is a clear and well-implemented system of controls, e.g. for methodology, documentation, and reporting
- most effective if focused on time-consuming, routine work (e.g. routine effluent sampling)

Incentives for Regulatory Staff

Staff must be well paid. This will help to:

- reduce staff turnover [highly qualified and specialized staff are difficult to find]
- maintain high ethical standards (and discourage payments of private sector 'commission' over the public sector basic salary).

Information Requirements

- must be clearly defined
- must develop and maintain procedures for documentation, records, and analysis
- only require information that is needed [in order to make important decisions]
- standard forms [or at least standardized reporting formats]

- staff must be well trained in the information management system

Training

Proper training can go a long way towards maximizing the CEP's effectiveness and efficiency.

Must Identify: training needs, target personnel, training aims.

User Fees and Charges

In this way 'the polluter pays'. Costs for inspection and auditing by the agency can be borne, partly or totally, by the regulated facility (charges). Discharge fees can be demanded for types and volumes of wastes produced. Other forms of charge include:

- one-time charge for initial permit application
- one-time charge for each new permit application
- annual charge for each permitted process
- annual charge for continuation of a permit
- charges for each inspection/ audit

Some potential disadvantages:

- fees must be less for better-performing facilities
- the regulated community should be consulted as to how the scheme can best be implemented
- fees should not be intended to be the sole method of cost recovery

Fines and Penalties

When a facility is in serious non-compliance, the fees/ penalties incurred can be put towards funding the agency.

Types of Violation e.g.:

- serious threats to public health and environment
- threats to occupational health and safety

- intentionally providing false information
- violations of procedure

Permits

The use of environmental permits can '...significantly improves the rate of compliance...' *(UNEP, 1995).*

Definition

An environmental permit / license sets out the acceptable design and operating conditions for meeting compliance requirements. Permits can save time and resources for both parties. The *permittee* knows exactly what is expected of it, and the agency knows exactly what to look for in its inspections. An efficient permit program can provide a platform for the phasing in of new requirements. Key issues to address:

- how should the permitting agency interact with inspection and enforcement agencies
- scope of the permit
- issuing procedures
- elements to be included in a permit application
- elements to include in the permit

The following are examples of elements that can be used to define the levels of permitting:

- important threats to public health and environment
- industry sector or sub-sector
- processes
- chemicals used
- facility size
- risk
- location

Issuing Procedures

The following elements should be addressed:

1. deadlines for:
    - submission of applications
    - government review of applications
    - issuing or denying a permit
    - duration of the permit
    - preparation and presentation to the public of a draft permit
2. time periods for public comment
3. provisions for public access to draft permits
4. provisions for appeals

Content of a Permit Application

1. description of facilities and operations
2. environmental impact statement and risk assessment
3. description of inputs
4. information on monitoring, documentation, and reporting procedures

Provisions of a Permit

As a minimum, the permit should include the following elements:

- identification of responsible parties
- provisions for changes in operations and processes
- requirements for record keeping and reporting
- statement of duty to comply
- duration of permit
- statement of duty to allow entry and access
- statement of duty to provide information

Quality Management of Permits

Provisions should be made for the feedback and evaluation of the quality of permits, and for making any necessary improvements. Therefore permit writers must work closely with enforcement staff to identify and rectify problem areas.

Common Problems with Permit Programs in Developing Countries

Condition	Possible Approaches
Insufficient Funding	- make clear and complete regulations a high priority - develop simplified permit conditions - set priorities
Imprecise and/or Incomplete Laws and Regulations	- clarify regulatory uncertainties - phase in the completion deadlines for uncertain areas, until clarified
Lack of Equipment for Monitoring	- plan longer or phased-in compliance schedules - focus on cleaner production techniques

Compliance Self-Monitoring, Inspections, and Enforcement

1. Compliance Self-Monitoring

This is the checking and recording of the actions taken by the facility to measure its environmental compliance performance, following procedural approaches agreed with the agency.

2. Inspections

These are on-site environmental reviews by the regulatory agency to check for any regulatory non-compliance.

3. Enforcement

This is the application of certain legal approaches in order to compel a facility to comply.

Developing a Compliance Self-Monitoring Program

A number of issues must be addressed by the agency as part of its work to develop the program, including:

- monitoring parameters
- procedures for documentation and reporting
- sampling strategy

- integration of all media

Inspections of a compliance self-monitoring facility are able to get much better information, especially because of the monitoring documentation. The frequency and intensity of inspections can possibly therefore be reduced.

Planning the Inspection Program

Three main aspects:

1. developing the inspection strategy- key facilities, parameters, frequency, scope and intensity, protocols, phasing-in etc.
2. guidance notes to inspectors-
   - authority
   - rules of conduct
   - selection of facilities and items to inspect
   - sampling equipment and procedures
   - reports and documentation
3. integration of all environmental media

4.5 Overview Of Environmental Management Techniques

4.5.1 Types Of Environmental Appraisal

Appraisals are an essential component of the environmental management system. They are designed to address the impact of operations on the environments and to identify all the protective measures which it is necessary to take. It is the responsibility of line management to ensure that appropriate appraisals are carried out prior to the commencement of any operations and subsequently to implement all measures identified as necessary to protect the environment. The main types of appraisal are as follow :

1) Environmental Screening

Environmental screening is used to identify potential environmental constraints in the proposed area of operations. It also provides a preliminary evaluation of how these constraints will affect the planed operations. It is carry out at a very early stage of planning in order to gain an overview of possible environmental problems. Factors which may be considered by an Environmental Screening include :

- requirements of national and international legislation;
- physical parameters;
- national / international significance of the area;
- conservation issues;
- economic factors;
- recreational issues;
- seasonal issues, e.g. fish/shellfish spawning, breeding birds or mammals;
- existing pollution levels.

The detail of the assessment will depend or vary according to the perceived sensitivity of the area;

2) Environmental Sensitivity Mapping

Environmental Sensitivity Mapping is a means of assessing the vulnerability of particular areas or sites to one or more contaminants. It provides a good interpretation of the vulnerability of environmental resources and identifies priorities for protection. They are widely used for comparing the relative merits of a range of alternative sites and in oil spill contingency planning. Typically Environmental Sensitivity Mapping involves assessing the proposed area of operation for

- concentrations of plant and animal life which could be threatened by pollution incidents;
- types of terrain which could affect the spread of pollution or have a significant impact on clean-up costs.

The results of the assessment are then summarized on a map of the area in order to provide a clear visual reference for locations of particular environmental importance and any seasonal variations in these.

3) Sensitivity Assessment

Objective

1. To identify the significant environmental and regulatory constraints that are likely to affect projected development activity in the area;
2. To identify potential problem areas associated with obtaining development permission, which might otherwise result in costs/delay in implementing the project;
3. To reduce risk of long term pollution liability and save resources by incorporating measures at the research/ development stage and the design stage which mitigate environmental impact of action;
4. To ensure credibility with permitting agencies and reduce the risk of damage to company image by specialist interest groups and the general public;
5. To identify sensitivities in areas of proposed seismic survey so that seismic contractors can be given appropriate instructions to minimize damage to environment;
6. To identify environmental requirements for rig equipment, site design, operation and abandonment prior to exploration drilling *(Schad,1991)*.

Method

Review the existing sensitivity assessment procedures as ;

- Identify the objectives selected and whether their purpose and intended use has been clearly defined
- Identify stages in planning, initiation and undertaking surveys e.g.:

    a) Desk preparation

        -Selection of environmental parameters

        -Analytical technique

        -Sampling technique

-Sampling area

-Distribution of sampling stations

-Number of samples

-Time of year

b) Exploratory survey

c) Baseline survey

d) Conclusions/suggestions for further work / recommendations

e) Report

(Adapted from Schad ,1991)

4) Baseline surveys

Baseline Surveys gather detailed qualitative and quantitative information on the environment of the proposed area of operations including such parameters as :

- inventories of flora and fauna;
- physical and chemical characteristics of air, water and soil;
- existing levels of pollution;
- identification of key habitats;
- ambient noise levels.

They are undertaken prior to the commencement of operations for the following purposes :

- to highlight those aspects of the environment which are particularly sensitive to impact and may require to be the subject of environmental monitoring.
- to establish the viability of the proposed operations (on onshore sites in particular existing pollution levels or other environmental constraints could involve major costs);
- to act as a basis for comparison with the results of environmental monitoring;
- to act as reference point in order to evaluate any subsequent claims of environmental damage.

5) Environmental Monitoring

Environmental Monitoring utilizes a system of periodic sampling or continual monitoring to assess the impact of operations on the environment. It will normally be preceded by a Baseline Survey and should aim to use the same sampling methods in order to enable a proper comparison. Environmental Monitoring can be used to :

- Demonstrate compliance with regulatory requirements or planning and development approval conditions.
- Monitor the efficacy of environmental protection measures and ensure improvement if these are inadequate.
- Assess whether the environment has suffered any long term damage.

Environmental Monitoring may occur throughout operations or it may commence in response to a particular event. It could be continued after the event or the completion of an operation in order to monitor for long term effects or to assess recovery from environmental damage.

Monitoring of Discharges and Effects

Discharge monitoring: This is the quantitative evaluation of specific waste releases, atmospheric, liquid, solid.

Effects monitoring : This is the quantitative and at times qualitative evaluation of specific environmental and socio-economic effects

Environmental Impact Monitoring : The systematic collection of physical, chemical, biological and related data pertaining to environmental quality, pollution sources and other factors that influence or are influenced by environmental quality. Data is compared with a fixed standard, such as a baseline survey, in view of the determined natural variability, to detect and measure any statistically significant changes. Management can be informed whether or not any changes in technology and/or procedures are required to achieve the desired level of environmental protection. Continuity with previous and future environmental assessment techniques *(Schad,1991).*

6) Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA), now 25 years old, was first developed in the United States *(Wood, 1995).* It was extensively imitated all over the world. Wood defined that "EIA is an anticipatory, participatory, integrative environmental management tool which has the ultimate objective of providing decision-makers with an indication of the likely consequences of their decisions relating to new projects or to new programs, plans and policies. Effective EIA alters the nature of decisions or of the actions implemented to reduced their environmental disbenifits and render them more sustainable." Wood believed that " **If it fails to do this, EIA is a waste of time and money."** An interesting definition of EIA was Kennedy's (1988). He mentioned that " **EIA is both science and art, hard and soft :**

EIA as '**science**' or a planning tool has to do with the methodologies and techniques for identifying, predicting, and evaluating the environmental impacts associated with particular development actions. EIA as '**art**' or procedure for decision-making has to do with those mechanisms for ensuring an environmental analysis of such actions and influencing the decision-making process ."

Caldwell (1989) emphasized that EIA is not a procedure for preventing actions with significant environmental impacts from being implemented. Rather the intention is that actions are authorized in the full knowledge of their environmental consequences. **EIA takes place in a political context** : it is therefore inevitable that economic, social or political factors will outweigh environmental factors in many instances. This is why the mitigation of environmental impacts is so central to EIA: decisions on proposals in which the environmental effects have palpably been ameliorated are much easier to make and justify than those in which mitigation has not been achieved." However, there are a lot of arguments such as the one that Kennedy (1988) pointed out that ' EIA is only integrated in decision-making (that is, it only works) when it is applied in a formal-explicit way '.

Several international agencies, such as OECD, UNEP, World Bank, pay much attention to EIA. UNEP has also made recommendations to member states regarding the establishment of EIA goals, principles and procedures. It subsequently issued guidance on EIA in developing countries.

In 1989 the World Bank ruled that the borrower country should normally accept the EIA under the Bank's supervisor. *(Wood,1995)*

Interest in EIA has burgeoned and there are now numerous EIA systems in existence worldwide. While the various EIA systems are all different in detail, their basic principles are very similar and demonstrate many common problems. The definition of 'Environmental' in EIA has been treated differently in different countries. The European Directive on EIA eschews consideration of social and economic impacts whereas the EIA systems in many countries evaluate impacts other than those upon the physical environment. Democratic decision-making procedures, economic and social factors will strongly influence the outcome as a result of the political process. The original stimulus for EIA in the USA was the neglect of the physical environment in decision making. That is why the European Directive on EIA was narrowly focused and it needs to be redressed *(Wood,1995).*

EIA system effectiveness

It is apparent that the success of EIA depends upon a large number of factors in addition to the precise nature of the procedures in force. Many of the opinions about EIA system effectiveness were reviewed by Wood (1995). The most interesting idea included:

Taylor (1984) believed that "the US EIA system worked because it was an administrative reform in tune with its times : supportive forces both inside and outside government worked together to ensure the effective implementation of EIA , and the changes in organizational behavior associated with it."

Ortolano, et al (1987) pointed out that " the effectiveness of EIA systems could be explained by reference to ' control mechanisms' : interorganizational and interorganisational processes and structures to ensure that the procedures actually worked. They advanced six types of control as causative : judicial; procedural; evaluative; instrumental; professional and direct public and outside agency. They suggested that two or more of these mechanisms usually operated simultaneously and that opportunities for public involvement played a key role in the exercise of each.

Kennedy (1988) said that " it would appear that EIA works best when it is instituted in a formal-explicit way. .... it works when there is a specific legal requirement for its application, where an environmental impact statement is prepared, and where authorities are accountable for taking its results into consideration in decision-making."

Caldwell's (1989) stated that " EIA will be most effective where environmental values (1) are implicit and consensual in the national culture and (2) are explicit in public law and policy.")

Evaluation of EIA system effectiveness

There is a need for an evaluative framework or comparing the formal legal procedures, the arrangements for their application, and practice in their implementation in EIA systems. This evaluative framework could be provided by analyzing the extent to which various principles are met by EIA systems. Wood recommended that " Perhaps the most rigorous example of the use of this type of evaluative framework is Gibson's (1993) analysis of the Canadian federal and Ontario EIA systems on the basis of eight ' interdependent principles for the design of effective environmental assessment processes as listed below

1. An effective environmental assessment process must encourage an integrated approach to the broad range of environmental considerations and be dedicated to achieving and maintaining local, national and global sustainability.
2. Assessment requirements must apply clearly and automatically to planing and decision making on all undertaking that may have environmentally significant effects and implications for sustainability within or outside the legislating jurisdiction.
3. Environmental assessment decision making must be aimed at identifying best options, rather than merely acceptable proposals. It must therefore require critical examination of purposes and comparative evaluation of alternatives.
4. Assessment requirements must be established in law and must be specific, mandatory and enforceable.
5. Assessment work and decision making must be open, participative and fair.
6. Terms and conditions of approvals must be enforceable, and approvals must be followed by monitoring of effects and enforcement of compliance in implementation.

7. The environmental assessment process must be designed to facilitate efficient implementation.
8. The process must include provisions for linking assessment work into a larger regime including the setting of overall physical and socio-economic objectives and the management and regulation of existing as well as proposed new activities.

(Source: Wood,1995)

An Environmental Impact Assessment (EIA) is a comprehensive and detailed review of the potential environmental impact of proposed operations on the physical, economic, social and culture environment designed to determine how all aspects of these operations can be undertaken whilst providing adequate protection for the environment. An EIA should include :

- full details of the proposed operations;
- a description of the physical, biological and socio-economic environment within which the operations will take place;
- identification of the nature, scale and likelihood of occurrence of potential environmental impacts arising from the operations;
- a description of the environmental management system which will be applied to the operations;
- identification of any additional environmental monitoring and control measures that are required;
- a non-technical summary of the above information.

The EIA is a living document and so long as operations are still projected or ongoing, the EIA must be periodically updated to take into account any relevant changes or updates to information. It is vital to appreciate that a *good* EIA serves as the bedrock of an effective and efficient environmental management program.

In the long run it will facilitate effective and efficient management. A poor quality EIA, however, could allow, or even cause, major problems that are subsequently difficult, expensive, and embarrassing to rectify. The temptation to dogmatically pick the cheapest of the bids for EIA consultant services *must* therefore be avoided- it is risky in the longer term. Conversely, some consulting firms will try to increase the study's scope and depth beyond what is required knowledge (e.g. with weeks of expensive laboratory work). Like many purchases, there is usually at least a rough correlation between price and quality. The developer must retain control over both these factors, and strike the best balance in order to satisfactorily investigate the issues in a cost-effective manner.

7) Risk Management

Risk management is an organized means of identifying and measuring risk and developing, selecting, and managing options for handling these risks *(Kerzner,1996).* Risk management strategy should be established early in a project and that risk be continually addressed throughout the project life cycle. Risk management methodology includes risk assessment, risk analysis, risk handling and lessons learned.

- ***Risk assessment*** - The first step in risk management is to identify and assess all potential risk areas. This is the process of examining a situation and identifying and classifying the areas of potential risk.
- ***Risk analysis*** - This requires conducting analysis to determine the probability of events and the consequences associated with their occurrence.
- ***Risk handling*** **-** This includes techniques and methods developed to reduce or control the risk.
- ***Lessons Learned*** **-** This includes methods for documenting lessons learned on risk management to benefit future decision-makers.

(Source: Kerzner,1996)

Quantitative risk assessment (QRS)

Risk assessment can defined as " the quantitative evaluation of the likelihood of undesired events and the evaluation of harm or damage being caused, together with judgments concerning the significance and acceptability of the outcomes." Risk is a function not only of the frequency of occurrence of an event but also of the consequence resulting from its occurrence *(Side, 1993).*

Risk Assessment Methodology

There is a systematic methodology to describe risk assessment, which can be characterized by six stages as follows :

1. hazard identification;
2. postulate accidents;
3. estimate likelihood (frequency) of accident occurrence;
4. estimate quantitatively the consequences;
5. calculate risk levels;
6. a 'so what' assessment or judgment stage.

Hazard Identification and Accident Pollution

There are many techniques available but mostly these simply provide a framework for creative thinking, and for the application of our experience and our foresight. There are now a variety of ***checklists*** available for particular systems and process and other techniques which is the most commonly used of which is ***HAZOP*** (Hazard and Operability Studies). It uses guide words to prompt ' what if ' type questions for each component of a system or plant.

Another qualitative technique is ***Failure Mode and Effects Analysis*** (FMEA). It is a standard method for determining the required reliability of critical components in a complex system, but is frequently used to study causes of failure and the consequential effects. All stages of a risk assessment should have a clear indication of the form of the undesired event in terms of outcomes.

Estimate Likelihood (frequency) of Accident Occurrence

Frequency Analysis is to evaluate the frequency of the undesired events or accident scenarios identified in the first stages of the Quantitative Risk Assessment.

Estimate Quantitatively the Consequences

The consequences of undesired events is usually concerned about human injury, environmental impacts or damage, and damage or loss of plant and equipment. Most models are concerned with establishing a series of zones of effect characterized by, for example, a lethal zone, a sublethal effects zone, extending to a non-observable effects zone. Most of these models can be seen as '*dispersion*' type models. The final task in this stage is that of providing an estimate of the consequence of such zones of effects.

Calculate Risk Levels

The final statement of risk is thus a summation of the risk arising from all of the accident scenarios which have been postulated. A measure of human risk can divided two types as firstly, society distinguishes between risk to the public and risk to the workforce. Risks to the public are expressed usually in two different ways individual risk and societal risk.

A 'So What' Assessment Stage

The final stage will find that enormous resources have been invested in detailed numerical evaluations. The principle of As Low As Reasonably Practicable (ALARP) is frequently used. It follows that risk assessment may require further cost benefit analyses and that the process is interactive. Quantitative Risk Assessment is iterative and we can see the application of it to reduce risk by considering modifications and the adoption of possible mitigative measures as part of risk management.

8) Environmental Auditing

An environmental audit means " a management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of helping to safeguard the environment by :

- facilitating management control of environmental practices;
- assessing compliance with company policies, which would include meeting regulatory requirements.

(Source: Evans, 1994)

This is the systematic examination of the organization's effects on the environment. It is a holistic, strategic management tool, that includes assessment of management policies. Audits can also be conducted on a more specific aspect such as waste, or energy. As far as possible the audit should be quantitative, with a structured scoring system, for performance against pre-set targets. An audit cycle of about three years is recommended under EMAS. Fundamental differences between audit and EIA include that an audit requires on-site measurements to be taken, and an EIA is a planning tool used at the process design and options stage. A successful audit must make the following assumptions about the EMS it assesses: full management commitment to EM; adequate resources are being allocated to EM; effective leadership in EM.

In other words these factors are assumed to be extrinsic to the scope of the audit. (They would, however, be intrinsic to a management review). During the earlier stages of an audit program (i.e. the first few audits undertaken), the audit serves primarily to *highlight areas of weakness.* In later audits this shifts to the provision of *assurance that 'all is well'.* There is therefore an important developmental change in the strategic significance of the audit program over time.

Scope of an audit:

1. company policy
2. communications and training
3. sites and buildings
4. raw materials
5. energy
6. products and services
7. processes
8. wastes and discharges
9. transport and distribution
10. accidents and emergencies

Internal vs External auditors

Internal auditors:
- have greater familiarity with the processes
- can often develop limited perspective
- might not always be brutally objective
- usually cheaper

External consultants:
- have more resources for auditing
- have broader perspective and experience
- can provide more objectivity
- usually better

Large multi-national companies can support a two-tier internal auditing system, with regular subsidiary audits backed by periodic 'external' audits by a visiting team from central office (*Tan and Hartog, 1991*). It should be noted that although such a system is relatively cost-efficient and could even provide a better quality of audit than work by external consultants, it could not easily be held up in public as third-party verification. The best approach is to use mainly internal audit, but re-enforced by occasional use of external audit. This provides the best balance of efficiency and quality. The additional costs would be outweighed by the reassurance, confidence, and public relations benefits that would result. Audit evidence can be considered as verification interview, document review, physical inspections, calculations and analysis, and measurements and testing. The Audit Cycle can be divided in 3 stages as follow ;

Stage 1: Pre-Audit Activities

1. Define Scope, Objectives, Terms of Reference
2. Create Audit Team
3. Prepare Pre-Audit Questionnaire
4. Plan the Audit Program: Process, Protocols*, Procedures, Sampling Techniques
5. Announce Audit to Staff

Stage 2: On-Site Visit Activities

1. Give Introductory Presentation to Site Management
2. Hold Initial Team Meeting
3. Conduct Inspection of Facilities
4. Conduct Interviews
5. Analyze and Evaluate Findings
6. Prepare Report
7. Present Findings to Senior Management

Stage 3: Post-Audit Activities

1. Consider and Implement Recommendations
2. Continue Monitoring Performance

*Note * The audit protocol is a manual consisting of a) questions with columns for scores; b) short guidelines to questions; c) concise instructions for auditors.*

Common Findings from Audits

Recommendations resulting from audit findings are most typically made in the following areas (*Tan and Hartog, 1991*):

- Incorporation of Environment in Organization and Responsibilities
- Management Commitment and Leadership
- Adequate Training and Awareness of Staff and Contractors
- Inclusion of Environmental Clauses in Service Contracts
- Consideration of Future Regulations
- Handling and Storage of Hazardous Substances
- Waste Management
- Release Inventory, Monitoring, and Recording

The quality of feedback is of course irrelevant if there is insufficient commitment to act (i.e. follow-up) on the advice given. A variety of inadequate management reactions to the emergence of problems (either through an audit or through an incident) has been noted (*Sexton and Visser, 1991*):

Management Responses to Audit Findings

Denial Actions

1. Observers dismissed/punished, records destroyed
2. Observers retained, but their findings disputed or denied

⇓

Repair Actions

3. Public denial/down-play of findings that have become public
4. Problem fixed at local scale, but wider implications ignored

⇓

Reform Actions

5. Local and wider issues acknowledged, full reconsideration and reform

Obviously, only reaction number five reflects well on management, and does not store up trouble for the future.

Maintenance and Inspection Program

A well planned and operated maintenance and inspection program provides verification at the most operational level, and is supported by less frequent internal and external audits. Operational maintenance and inspection programs should include criteria relevant to EM, e.g. integrity of valves, bounds, waste storage etc.

A quantitative environmental management and audit system :

Commercial Rating Systems (IERS)

Det Norske Veritas (Norway) developed a quantitative environmental management and audit system, the International Environmental Rating System (IERS). IERS is compatible with EMAS. IERS is an environmental performance tool which provides the means for systematic analysis of all aspects of a company's environmental management system to determine the extent and quality of management control *(Evans,1994).*

Each key element of the management system is given a rating value, based on ratings for its constituent sub-elements. IERS has 18 elements [see below], and these can be implemented in a phased program over a number of years, each element being under the direction of an appropriate line manager. A performance target could be, for example, achievement of a 70% rating by 1999, and the system is well suited to setting medium-term (e.g. three-year) goals. This allows management to see where the problems are and where the successes are. It also shows where results are greatly in excess of satisfactory, thus enabling efforts in that area to be reduced in order to concentrate on raising standards elsewhere.

As with all checklists, however, the user should always keep in mind that the contents of the checklist do not necessarily equate precisely to the relevant issues concerning the user. There is a danger of lapsing into a 'checklist mentality', where issues may be overlooked simply because they are not in the checklist. Over-reliance on a checklist could result in an incomplete or poorly focused understanding of the real strategic issues to be addressed. It is therefore necessary to always keep an open mind in auditing. Partly for this reason many larger E&P companies have adapted such 'off-the-shelf' checklists to fit their own needs *(Guklian, 1991, Whitehead, 1991, Walters and Henderson, 1993).* The environmental profile coupled with the scoring from the last audit may also be used to identify actions to improve environmental performance and to set specific targets. Measurements against the targets by regular audits are easy at any point in time. The International Safety Rating System (ISRS), and are commonly used in the E&P industry.

New Economic Tools for Environmental Management :-

Cost / Benefit Analysis (CBA)

CBA relies upon choices being made, dependent upon judgments informed by analysis. The analysis expresses as many impacts of a policy as possible in monetary terms. The net cost or benefit can then be derived as a guide to setting ambient price levels.

9) Integrated Management system

The safety/health and environment relationship

An integrated, holistic approach would be beneficial in eliminating any interface problem between environment and safety/health and would also avoid the duplication in effort if attempting to set up and use separate systems. The Americans, also following Lord Cullens advice, to a certain extent have drawn up Safety and Environmental Management Program (SEMP). This is an integrated approach for the management of safety and environmental aspects for oil & gas activities, and is currently voluntary.

Safety Management

Safety management systems are based on quality management, and basically have the same structure as an environmental management system. Regulation 8(1)(a) of safety case regulations places a duty on any person required to prepare a safety case, and to include in it a demonstration that the management system is adequate to ensure compliance with statutory provisions. The SMS is a description of the controls and tools that management has established to ensure that the company activities are conducted in as safe a manner as is achievable.

The Safety and Environmental Program (USA)

RP 75 - "Recommended Practices for development of a safety and environmental program for outer continental shelf operations and facilities" approved by the American Petroleum Institute. RP 75 covers general SEMP practices as follow :

- Management safety and environment protection policy;
- Organizational structure related to safety and environmental protection;
- The safety and environmental protection responsibilities procedures of company officials, representatives, employees, and contractors;
- Safety and environmental protection training;
- Inspection for facilities - assuring safe;
- Corrective action;
- Accident prevention and investigation program;
- Internal review and audit of SEMP policies and procedures;
- Procurement;
- Documentation of program activities.

(Adapted from Rudge ,1994)

SEMP is designed to reinforce the responsibility of the operator, as in the safety case, for assuring safety and environmental protection during operations. SEMP is merely the next step in the US, as the US Department of Interior Minerals Management Service (MMS) has already responsibilities for safety and also environment protection in their regulatory and inspection policies - something that there is a lack of, in the UK *(Rudge, 1994).*

4.6 EU Environmental Guides : Regulatory Affairs

4.6.1 Control of Industry Emissions

1) Best Available Techniques (BAT) : Control of Industrial Emissions

The concept of BAT was first introduced in Council Directive 76\464\EEC concerning the discharge of dangerous substances into the aquatic environment. The Directive states that limited values for the discharges of certain dangerous substances have to be set while taking into account the "best technical means" available. The concept of BAT has been further developed which is known as *"BATNEEC" (best available technology not entailing excessive costs) (Adapted from the EC Committtee,1995).*

2) Integrated Pollution Prevention & Control (IPPC)

Must EU environmental policy has been based on instruments which separately regulate the control emissions from industrial plants into three receiving media: air, water and soil. This policy has changed in the past four or five years, with the UK, France, the Netherlands and the Flemish part of Belgium having already their own legislation, permit systems based on an integrated division of the approaches to the protection of the different environmental compartments. The proposal essentially deal with the establishment of statutory instruments and procedures to grant discharge and operating permits to new installations and to renew previously granted operating licenses to existing plants. The integrated approach must ensure that none of the three media is preferred of sacrificed. The Directive leaves the responsibility of setting BAT based emission limits to individual Member States. The same principle applies for most of the environmental quality standards (EQS) setting activities *(Adapted from the EC Committtee,1995).*

3) Eco-Management & Audit Scheme (EMAS)

The objective of the EMAS is to promote the use of environmental management systems and auditing as a tool for systematic and periodic evaluation of the environmental performance of certain industrial activities. The Council Regulation 1836/93/EEC allowing voluntary participation by companies in the industrial sector in the scheme. Companies registered under the scheme will be obliged to :

- adopt a company environmental policy;
- conduct an environmental review;
- introduce, in the light of that review, an environmental programme and an environmental management system;
- carry out an environmental audit; and
- prepare an environmental statement of the results for the public domain.

*(**Source :** Adapted from the EC Committtee,1995)*

4) Environmental Impact Assessment (EIA)

Directive 85/337/EEC requires an EIA before consent is given for certain public and private projects that are considered to have significant environmental implications. The types of projects which required for EIA as listed in Annex I and II. Eleven types of installation are identified in Annex I which require public consultation before development consent is given. These include :

- crude oil refineries;
- power stations and other combustion plants of more than 300 MW;
- the storage and disposal of radioactive wastes installations,
- foundries;
- the extraction of asbestos installations;
- integrated chemical installations;
- motorways, express roads, long distance railway lines and air-ports of a certain size;
- port vessels over 1,350 tons;
- waste disposal installations for the incineration, chemical treatment or land fill of toxic and dangerous waste.

Annex II of the Directive lists projects which require an impact study only if Member States believe special circumstances necessitate it. These include : mining; energy; chemicals, metal-working, food and agriculture, tourism and leisure developments.

*(**Source :** Adapted from the EC Committtee, 1995)*

5) Environmental Standards

Environmental standardization is strongly related to EU environmental Directives. There are two general categories of standards of principle concern which are Environmental Management Standard (EMS) and Product and Pollution Control Standards (PPCS). Just as Quality Management Systems (QMS), which was developed by the ISO, have become accepted markers of good business practice and also are quickly becoming "required practice" in the international market place, EMS's are widely expected to assume the same role in the environmental protection field and become required in the ever expanding "green" market - place.

*(**Source :** Adapted from the EC Committtee, 1995)*

Section 5

CHARACTERISTICS OF THE OIL AND GAS INDUSTRY IN THAILAND AND UK

5.1 Thailand Oil & Gas Industry

5.1.1 Introduction

Gone are the days when Siam was just a picturesque agriculture kingdom : the 'land of smiles' has become a ***'little dragon'*** *(Sallavuard, 1993)* and will be one of the *Newly Industrialized Countries* of the 1990s with a trend to become a ***'new young smiling dragon!'*** in the near future (researcher's opinion). Thailand is advancing in its industrial and economic development. Its energy demand is growing at the same rate as its GDP. It is anticipated that petroleum demand may be as high as 1,180 KBDE by 2006 *(DMR(1),1996)*. During the past decade, the economic growth rate rapidly went up and led to a rapid rise in energy consumption, petroleum in particular, and the country had to rely heavily on imported petroleum. Thailand has to import up to 60% of its commercial energy consumption, mainly in the form of petroleum, some 30% of national petroleum consumption is from its own resources *(Taranajesda,1996)*.

Thailand continues to have the highest growth rate in energy consumption in the world. Its energy use, in the forms of petroleum products and electricity, is one of the highest in the world *(DMR(1),1996)*. Due to increasing demand for energy in the country, the Thai government has continued to promote petroleum exploration and production in the country, especially wishing to attract international oil companies. An attractive fiscal regime, favorable geological prospects, good infrastructure, readily available markets and a booming economy make Thailand an excellent place for oil companies to expand their activities. All possible sizes of petroleum field are taken into account for this purpose.

5.1.2 Exploration History

Thailand's history of petroleum exploration goes back to 1921 (over 70 years) in the Fang Basin in Northern Thailand where oil seeps have been reported *(DMR(1),1996).* A number of shallow wells were drilled in the area by various government organizations which was prior to the start of Second World War. After the War the Department of Mines was given the responsibility of exploration. In 1954 Thailand changed its attitude to petroleum exploration by allowing private sectors to become involved. In the same year the country's first oil discovery was made at the Fang Basin by the Department *(DMR(1),1996).* [This operation was later taken over by the armed forces 'Defense Energy Department (DED)' *(The Report to DMR,1996)*].

In 1956 the responsibility of exploration was given to DED until 1962, when private companies were permitted to enter the market. No significant discoveries had been made up until then. Based on mining law, production permits were granted to six companies in 1968, in the Gulf of Thailand. In 1971 Union Oil (which later become UNOCAL), the first private oil company, drilled the ***first*** onshore deep well, ***Kuchinarai-1***, and Conoco the first offshore well, Surat-1, *(DMR(1), 1996).* Unfortunately, both exploration wells failed to encounter hydrocarbon. In the same year the Petroleum Act and the Petroleum Income Tax Act were introduced and become known as 'Thailand I'.

Licensing rounds held in 1972 and 1974 saw the award of blocks in the Andaman Sea. In January 1973 the first significant discovery, 12-1, in the offshore area (Gulf of Thailand) was made by Union Oil *(DMR (1),1996).* The discovery was later named 'Erawan Field'. In May 1973 Tenneco made one of the most important discoveries in the offshore Malay Basin, when wildcat 15-B-1X was abandoned as an oil and gas well *(DMR (1),1996).* Although not originally thought to be large, later drilling by BP and Texas Pacific confirmed the presence of a sizable gas accumulation which subsequently became known as the 'B' structure. Currently, this field is operated by Total as the 'Bongkot Field' and production rates are highly impressive.

In 1978 Union Oil signed a sales contract to supply gas to the domestic market, and the development of the Erawan Field began immediately thereafter, with production commencing in

August 1981. In 1981 Esso discovered the 'Nam Phong' onshore gas field and Shell the 'Sirikit' onshore oil & gas field *(DMR (1),1996)*. A number of successful wells were drilled in the 1980s on this acreage. Commercial petroleum production began in 1981. In 1982, due to high global oil prices in the early 1980s a new fiscal regime, known as 'Thailand II', was introduced. The new regime introduced 20% limit cost recovery of annual gross revenue and increased royalty corresponding with an increase in production rate. This period saw the entry of a number of new companies into the offshore area as a result of acreage being made available due to part and total relinquishments.

In June 1987 Shell made the first substantial oil discovery, 'Nang Nuan-1', in the Gulf of Thailand. The field was first brought onstream in January 1988 and is currently Thailand's largest offshore oil producing field *(DMR (1),1996)*. The later year (in November) British independent Premier Consolidated made an offshore oil discovery at 'Songkhla-1' (Gulf of Thailand). A new fiscal regime, 'Thailand III', became effective in 1989. This was introduced for the 13th Licensing Round in June 1990. One of the main changes was the revision of the royalty rate to a sliding scale to enable commercial production for all sized of fields *(DMR (1),1996)*. In June 1990 UNOCAL discovered the 'Pailin' offshore gas (in the Gulf) and condensate field in B12/27. One of the more significant discoveries made to date in the 13th Round blocks is 'Tantawan' offshore oil and gas field (in the Gulf) by Maersk.

In 1993 Total made an important gas and condensate discovery at 'Ton-sak'. The giant structure is located in B 15 east of the Bongkot Field and during 1994 it has successfully been appraised. On April 1994 a historic production sharing contract was signed by the Malaysia -Thailand Joint Authority in overlapping zone *(DMR (1),1996)*. A year later (in May) Maersk made a second oil and gas discovery, 'Benchamas-1', in B8/32 (the Gulf of Thailand). At the end of 1995, the total number of wells drilled in Thailand was 1,344 *(calculated from DMR (1),1996 and DMR(2),1996)*. Over 20 fields are producing hydrocarbons and several development projects are planned. Since 1971, a total of 13 rounds of concession bidding have been completed, 104 applications submitted and 47 concessions awarded *(DMR (1),1996)*.

A summary highlighting petroleum exploration and production history is shown in Table 5-1.

Table 5-1 Thailand E&P activities history reviews

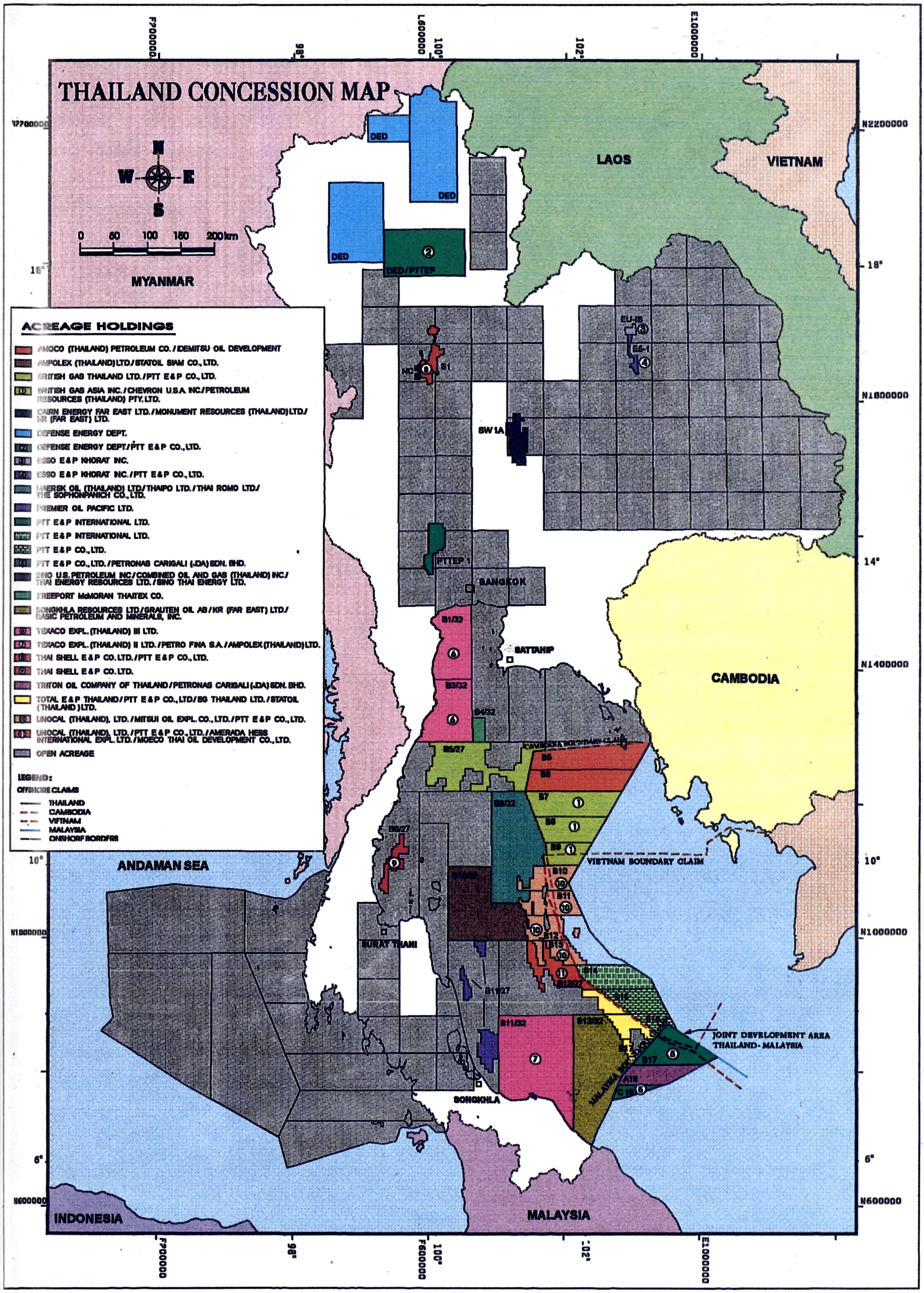
Year	Highlights
1921	Petroleum exploration began
1954	Conducted aeromagnetic & gravity surveys
1957	Drilled 4 wells
1962	First awarded concessions to private companies
1971	Petroleum & petroleum income tax Acts were first promulgated
1972	UNOCAL discovered first offshore " Erawan " gas field (Gulf of Thailand)
1976	Tenoco and BP found " Bongkot" offshore gas field
1981	Commercial petroleum production began in 1981 Thai Shell discovered the "Sirikit" onshore oil field Esso discovered "Namphong" onshore gas field UNOCAL started producing
1983	Thai Shell started producing
1987	North Central found " Bung Ya" onshore oil field BP discovered "Uthong" onshore oil field Thai Shell found "Nang Nuan" the first commercial oil field struck in the Gulf
1988	Premier Oil found oil in its first well in "Songkhal" basin
1989	Petrocrop found crude oil and natural gas in "Vichianburi" onshore field
1990	Esso started producing BP found "Pailin" and "Morakot" offshore (the Gulf) gas fields
1991	BP & NCII started producing
1993	Maersk Oil found crude oil and natural gas in "Tantawan" offshore (the Gulf) field Total started to produce gas and Condensate from "Bongkot" field
1994	a historic production sharing contract was signed by the Malaysia - Thailand Joint Authority in the overlapping zone.
1995	1,344 wells were drilled and over 20 fields producing in Thailand

(Applied from the Report to DMR, 1996 and DMR (1)(2),1996)

5.1.3 Current Activities

1) Concession Bidding Rounds

Up to February 1996, 15 bidding rounds have been held for petroleum concession blocks in Thailand announced by the Department of Mineral Resources (DMR) granted by the Minister of Industry. In the former bidding round (14th round) only exploration blocks in the Andaman Sea were opened for bidding while all exploration blocks except in the Andaman Sea were opened for the latter, the 15th bidding round. At present, there are 29 concessionaires of which there are 18 offshore concessionaires *(the Report to DMR,1996).* See petroleum concession blocks in Fig. 5-1.



FEBRUARY 1995

Fig. 5-1 Thailand Petroleum Concession *(Source : DMR)*

2) Exploration

Seismic Survey

During 1995, a total of 3,586 line-km of 2D seismic surveys were conducted both onshore (135 line-km) and offshore. Most of the lines were operated in Andaman Sea (3,298 line-km) operated by DMR *(DMR(2),1996).* For 3D seismic survey, a total of 4,058 line-km were carried out in the offshore area by the concessionaires.

Drilling

In 1995, 110 wells (106 offshore wells) were drilled (compared to 113 in 1994) comprised of 1 exploratory (onshore), 32 appraisal and 77 development wells *(DMR(2),1996).* To the end of 1995, the total number of wells drilled in Thailand was 1,344 (1038 drilled wells in the Gulf, only 13 exploration wells in Andaman Sea) comprised of 211 exploratory, 273 appraisal, 805 development, 29 stratigraphic and six service wells *(calculated from DMR (1),1996 and DMR(2),1996).* One new prospect was discovered in 1995 *(DMR(2),1996),* compared to two in 1994 and one in 1993 *(the Report to DMR,1996).*

3) Production

In 1995, Thailand produced 401 BCC of gas, 10.9 MMBBL of condensate, and 8.2 MMBBL of crude oil *(DMR(2),1996).* The gas production increased by 5.6 % but condensate and crude oil production decreased by 2.2 % and 12.2 %, respectively over that of 1994. A total petroleum production of the country was equivalent to 91 MMBBL of crude and account for 28 % of petroleum consumption in the country.

Gas and Condensate Production : All offshore production is in the Gulf of Thailand. The main offshore gas (70%) producer is UNOCAL and the highest gas and condensate production was from Erawan at 260 MMCFD and over 8,700 BPD respectively. *(DMR(1),1996).* Onshore Esso's Nam Phong and Shell's Sirikit Fields produced gas at over 60 MMCFD each *(DMR(1),1996). Crude Oil :* Over 80% of oil produced was from Shell's onshore Sirikit Field and its satellites *(DMR(1),1996).* The 1995 sale value of crude oil, condensate and natural gas were 3.7, 4.5 and 19.7 billion baht, respectively (£1 = baht 40). Base on the production plan of the operators oil and condensate will be produced in the order of 60,000 BPD for the next five years. Gas production will be increased from 1.3 billion cu.ft. per day in 1996 to 2.2 BCFD by the year 2000 *(DMR(2),1996).*

5.1.4 Petroleum Fields

Up to 1995, a total of 42 fields of petroleum resources of commercial quantity were discovered, 21 field are oil fields, 17 are natural gas and condensate, and 4 are natural gas *(Taranajesda V,1995).* At present petroleum is produced from 18 fields (10 -offshore, 8-onshore) *(the Report to DMR, 1996). See Fig. 5-2.*

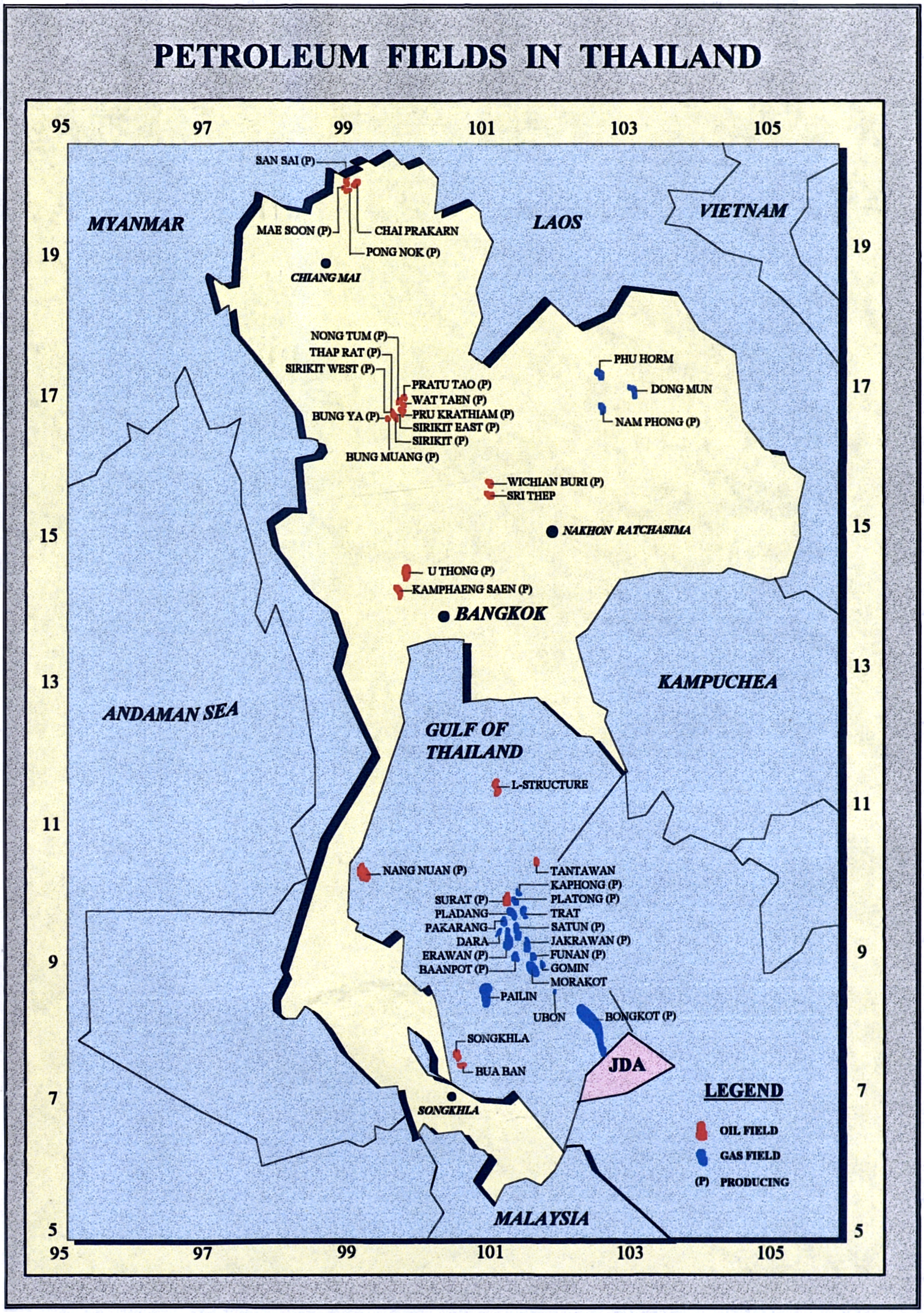


Fig. 5-2 Petroleum Fields in Thailand (Source : DMR)

Petroleum Data Section
September 1995

5.1.5 Petroleum Reserves *(as of December 1995)*

The total proven, probable and possible natural gas reserves were updated as 7.21, 9.98 and 11.67 TCF, respectively. Condensate, the gas-associated fuel particularly found in offshore, were estimated at 166.51, 234.67 and 128 MMBBL for proven, probable, and possible reserves, respectively. The total proven, probable and possible crude oil reserves were updated to 128.75, 61.46 and 141.12 MMBBL, respectively *(Adapt from DMR(2),1996).* Approximately 15 % of gas, 18% of oil and 17% of condensate reserves have so far been produced *(DMR(1),1996).*

5.1.6 Petroleum Potential

The petroleum potential of Thailand can separately be considered in six regions. These consist of Northern Thailand, the Central Plain, the Khorat Plateau, the Gulf of Thailand, Southern Thailand and the Andaman Sea. The highlights in 1992-1995 are shown in Table 5-2

Table 5-2 The E& P highlights in Thailand during 1992-1995

Activities	1992	1993	1994	1995
1) **Concessions**				
• No. of concessions	29	29	22	21
• No. of concession blocks	45	45	30	28
2) **Geophysical surveys**				
• by (concessionaires)	14	8	8	?
• in (blocks)	24	11	11	?
• magnetic (km)	6,490	3,511	0	0
• gravity (km)	9,635	3,472	0	0
• 2-D Seismic (line-km)	30,603	8,106	1,667	3,586
• 3-D Seismic (line-km)	733	17,240	13,448	4,058
3) **Drilling**				
• by (concessionaires)	7	12	13	?
• with (drilling rig)	8	8	15	?
• in (blocks)	12	16	19	?
• exploratory (wells)	6	12	11	1
• appraisal (wells)	21	8	27	32
• development (wells)	64	84	75	77
4) **New Prospects**				
• No. of new prospects	2	1	2	1
5. **Production (Total Sale)**				
• by (concessionaires)	5	6	6	7
• from (fields)	15	19	19	21
• Natural Gas (BCF)	290	332	365	401
• Condensate (MMBBL)	9	10.3	11.5	10.9
• Oil (MMBBL)	?	?	9.1	8.2
• Values (bil. baht)	25.21	25.88	27.28	27.95
• Royalties(bil. Baht)	3.16	3.22	3.40	3.48
6. **Total Ultimate Reserves**				
• Oil (MMBBL)	-	-	283* (491)	?
• Natural Gas (TCF)	-	-	17.2*(17.6)	?
• Condensate (MMBBL)	-	-	472* (494)	?

NB: * as of Jan 1994, ( ) as of Jan 1995, ? No information

Source: *Adapt from the Report to DMR, 1996 , year 1995 source from DMR, 1995*

5.1.7 Thailand-Malaysia Joint Development Area (JDA)

Wuttishingchai (1996) reviewed that the Malaysia-Thailand Joint Authority (MTJA) has been established in 1992 in order to assume the rights and responsibilities for the exploration and exploitation of petroleum resources in the area claimed by both countries : the joint development area (JDA). The joint area is an overlapping continental shelf in the lower part of the Gulf of Thailand claimed by both Countries *(the Report to DMR,1996).*

The area is about 7,250 sq.km and promising for gas potential under the Production Sharing Contracts system, which awarded contracts in April 1994) *(DMR(2),1996).* The contract period is 35 years. There would be two investors who intend to venture in the area. Up to October 1994, seismic surveys have been conducted in the joint area, for total of 11,970 line-km and 620 sq.km of 3D seismic surveys covering the Cakerawala (Pilong) Field *(DMR(2),1996).*

At the end of 1995, the contractors drilled 5 wells. Two exploratory wells in block B-17 have found gas. The Muda-1 well was tested with a combined flow rate of 70 MMCFD of natural gas and 726 BPD of condensate. The second well, Tapi-1, has a combined flow rate of 8.9 MMCFD of natural gas and 66 BPD of condensate *(DMR(2),1996).* Exploration to date revealed that the JDA has high potential of gas and condensate of at least six trillion cu. ft *(DMR(2),1996).* With the of the success of the five wells, the exploration is now being accelerated.

5.1.8 Thailand -Cambodia -Vietnam Overlapping Area

In 1971-1973 Thailand, Vietnam, and Cambodia announced their continental shelf boundary in the Gulf of Thailand, respectively, which caused an overlapping area of approximately 32,000 sq.km. In April 1975, the Thai Government and neighboring countries could not reach an agreement on the disputed boundaries. In 1991, the Government assigned the Ministry of Foreign Affairs and the Ministry of Industry to solve the boundary disputes together with finding a proper solution for developing non-living natural resources in this area as soon as possible. Since that time, negotiations on delimitation of the continental shelf between Thailand and Combodia, Thailand and Vietnam have been made with substantial progress in an atmosphere of co-operation and sincerity.

5.1.9 Thailand Pipelines

The offshore section will be 36 in. in diameter and run 425 km from Erawan's main production platform to a receiving terminal at Mab-Ta-Pud. PTT's board gave a green light to the $360 million, 331 km offshore system to bring more Gulf of Thailand gas to landfill on the southern peninsula *(West,1991).* The project entails first laying a 32 in., 170 km line from the B structure gas field, under development by a PTTEP-led group, to UNOCAL's Erawan gas field. A second, 27 in. line will extend west from Erawan field to landfall Khanom, Nakhon Si Thammarat Province, where two 300,000 kW, gas fired, combined cycle plants are planned *(West,1991).* The new onshore line will be 28 inch and run 110 km to Bangkok area. The commissioning of the Bongkot to Erawan line, as well as the following Erawan-Bangkok line, will allow gas from the Malaysia-Thailand joint development area to be developed. The distance from the JDA to Bongkot is only some 150 km *(Scholes,1994)* .

5.1.10 A Closer (Study) of Environmental Impacts from E&P Development in Thailand

As is known, impacts can occur in all E&P phases, if the environmental management in the operations is poor. No really serious environmental problems has occurred so far in Thailand *(Taranajesda,1996).* The industry's environmental track record in Thailand has been sound *(Upstream Petroleum Industry of Thailand Task Force, 1993).* Statistics from major accidents in the petroleum industry which have great environmental effects show that most of them resulted from carelessness and negligence of the workers, not from the failure of the equipment. However, documented evidence confirms that existing environmental issues are easily managed within Thailand's existing environmental management regime *(Upstream Petroleum Industry of Thailand Task Force, 1993).*

5.1.10.1 DMR Investigations

The Department of Mineral Resources (DMR) started the project (during 1991-1994) on 'Investigation, Evaluation and Policy Guideline Setting for Environmental Impacts Management From Petroleum Development of Thailand', which was studied by the Environment Division (ED).

Also there was an other project study (in 1989) on 'Environmental Impacts Assessment Concerning Petroleum Exploration and Production in case study of onshore areas' which was produced by the author, as an ex-officer of the Mineral Fuels Division (MFD). The main result from the ED project study including the author project study found that in the case of

a) Onshore Operation Areas

During the period of the fiscal year project study, there had been many E&P activities in onshore areas (more than 10 operators such as Thai Shell, Esso Khorat, Esso Udon, Esso Scol, BP, NCLL, Premier, UNOCAL, Mersk, Sino, PTT E&P, Cairn). Restrictions on time, budget, and manpower limited the scope of work project. Only Thai Shell, Esso Khorat, Esso Udon, Esso Scol, BP, NCLL, and Premier operation areas were investigated. The main hazardous wastes such as Produced water, Oil-Based Drilling Mud, Drilled Cutting, Waste Sludge (only from API unit of Thai Shell), and including surface and underground water, soil around operation areas were collected as samples for laboratory study. The main result of the study found that

a.1) Physical Environment Problems

- most of the site operation areas (operating during the investigation) were clean and looked as if environmental had been taken care, especially, in the production operation areas operated by, Thai Shell, Esso, BP and NCLL;

- No serious environmental problems (water, air, noise pollution and oil / chemical spills) were found within the operation and surrounding areas;

- only small discharge wastes water (contaminated with oil / chemical / salt) overflow from some Mud Pits (Holding Basin) and from rain water drainage way (caused by heavy rain water) contaminated surrounding soil (rice field).

- soil in Mud Pits area and some small surrounding areas (rice field) were contaminated (easily to see) with crude oil (on soil surface and sub-soil (by 50 cm cross-section depth found quite fresh oil.

- very high concentrations of salt were scattered on the soil surface at Mud Pits area and some surrounding areas (rice field) following the land slope and water-way within a radius 10-50 m.

- soil in some of the Exploration Well Sites can not be reused or recover for agriculture (rice fields) or forest (in the case of Well Sites located on the conservative forest lands (in fact it was half-deforested and unhealthy, even though the wells were suspended more than 2-6 years previously. However, the operator recover all sites area, which located on the reserved forest areas by growth on the forest farm.

- some Abandoned Exploration Well Sites area were still found to contain amounts of the Drilled Cuttings in the Mud Pits area (which looked as if the operator had not to treated and disposed of according to Good Petroleum Industry Practice *(Petroleum Act, Section 80).*

- more than 60% of unused Mud Pits were not filled up and land restored as the Petroleum Act required *(Under Ministerial Regulation No. 12).* . However, most of the unfilled Mud Pits were still in a good condition and some of them were reused by the local people. The rain water in some of the Mud Pits were used for cattle, farming, swimming (by local children and ducks), etc. Fortunately, the result of the water samples quality from this reused Mud Pits were not found to have toxic parameters (such as heavy metal, oil or salt etc.). However, it does not mean that water in every Mud Pits is save. Only one or two sample collections can not be the representative for the whole.

- some of the Abandoned Sites, especially in the Central and North-Eastern Part of Thailand Concessions, were reused by the local people (farmers) with permission from the operator, but in some case were not permitted by the operator (may be because of safety reason).

- soil in rice fields (only small areas) near the operation areas were contaminated with high concentrations of salt (noticed from the amount and thickness of Salt Crystals).

- Some farm land (Corn & Bean fields) was damaged by the heat from gas flaring;

a.2) Waste Water Discharge Quality

Waste Water in Mud Pit

most of wastes water (especially, the fresh ones) were contaminated with oil, chemical, salt, suspended solid, and (or may be) heavy metals.

Produced Water

Produced water was contaminated with oil, chemical, salt, suspended solid, and heavy metals *(such as Mercury (Hg) was found in produced water form ESL fields.*

a.3) Soil Contaminated

- soil samples in the surrounding areas (rice fields) near Mud Pits areas was contaminated with high concentrate of salt (SO_4, Na, Cl, Mg, Ba) some heavy metal (Hg, Cr, Cd , As) and Oil;
- In the case of ***the first exploration Well*** *(was drilled in 1971)* ***in Thailand.*** Surprizing, soil samples in or around *Mud Pits* area* at 'Ku-chi-na-rai Well', ***,26 yrs old, were contaminated with some heavy*** **metal** (such as Hg, Cr,Cd). May be from the other source?. (* expected by *three* MFD officers, who were response for field work inspectors in this area)

a.4) Sludge Waste

Many drums (more than 20) of oily sludge waste from Sirikit oil field (API Unit) was collected and waiting for disposal.

a.5) Air Quality

Air quality around the operation and living platforms was not found to be contaminated with Natural Gas or Toxic Gas (such as S_xO, N_xO, CO_2)

b) Offshore Operation Areas

Only UNOCAL Thailand Ltd. production operation areas, such as Production and Living platforms (Erawan, Satun, Funan, Platong); Floating Storage Unit (Erawan FSU); onshore facilities areas (Songkhla province) (Laboratory, Contractor' Warehouse, Mercury storage areas) were investigated. The main hazardous wastes such as Produced water, Waste Sludge (from FSU), were collected in two set of samples for reducing laboratory error study (by comparing between the result of DRM's and UNOCAL's). The main result of the study found that

b.1) Physical Environment Problems

- all of the Operation Platforms areas, Living Quarter Platforms, FSU, mercury storage areas, and including the sea surface were clean and looked as if good environmental had been taken care;
- Schools of fish were evident around the operation platforms,
- No serious environmental problems (water, air, noise pollution and oil, chemical, mercury spill) were found within the operation areas (including Sea water);
- only some small oil spills were noted (as an oil film) contaminated with sea water (at surface level) sourced from one of the contractor supply boats and from Erawan FSU (during loading condensate or might be from ballast water);

b.2) Waste Water Discharge Quality

Produced Water : Produced water was contaminated with oil, chemical, salt, suspended solid, and heavy metal *(such as Mercury (Hg), Arsenic (As), Cr (Chromium), Cd (Cadmium) ect.).*

Sludge Waste : Sludge from the production operation contaminated with very high concentrate of Oil, Mercury and Arsenic etc. More than 300 drums of toxic sludge (80% from Erawan FSU) were collected (as in good practice) and were waiting for the right methodologies for disposal. At present , there have been some problems with the treatment and disposal of waste hydrocarbons.

b.4) Air Quality

Air quality around the operation and living platforms were not contaminated with Natural Gas or Toxic Gas *(such as S_xO, N_xO, CO_2, Mercury)* except in the Mercury drainage point at API unit zone and storage areas

5.1.10.2 Monitoring of The Upstream Oil &Gas Industry of Thailand

Extensive offshore (in the Gulf of Thailand) Environmental Assessment studies have been conducted by UNOCAL Thailand Ltd. The results of these studies pointed out that discharges of primary environmental focus include three major types as follows;

- Oil-base drilling muds and cuttings generated during well-drilling operations, which may contain elevated petroleum hydrocarbons (PHC);
- Produced water may contain elevated concentrations of mercury and or PHC;
- Solids generated during gas processing and gas/condensate/water-separation treatment, which may contain elevated concentrations of mercury.

(Upstream Petroleum Industry of Thailand Task Force, 1993)

The studies found that

1. the nature of the biological change was remarkably similar across platforms, despite some physical, geographical, temporal, and possible neighborhood effects,
2. there was evidence of sharp environmental gradients and, to a large degree, localization of the principal effect of biological impoverishment to within about 100 m of a platform,
3. slight biological changes noted up to 1 km from platforms,
4. with respect to time, biological recovery of inner zones around platforms was evident five years after wellhead drilled,
5. levels of mercury in edible mussels and fish tissue were below action limits set by FDA and FAO,
6. the to date assessment reports confirmed that given the scale and natural of the petroleum development in the Gulf of Thailand, "the potentially adverse environmental effects are minor and 'easily managed'.

(Applied from : *Upstream Petroleum Industry of Thailand Task Force, 1993)*

However, the result of environmental monitoring (in 1993) around UNOCAL platforms has shown no significant effects on marine environment. Hydrocarbon and mercury contamination in sediment, fish and marine life within a radius of 500-1000 meters from the platforms is in low level concentrations.

Mercury Problems :

UNOCAL (1989) reported that in August 1985, mercury was first physically located and recovered from vessels downstream of the hydrocarbon dew-point control units (DPCUs) of the Platong 'CPP' process facility, six months after start-up. In August 1986, was located in the Satun 'CPP' systems; eight months after field start-up. It has been concluded that the DPCUs' cooling of sales gas for control of the hydrocarbon dewpoint, results in condensation of mercury vapors transported through the process systems with the gas *(UNOCAL, 1989).*

The Upstream Petroleum Industry of Thailand Task Force (1993) analysed that 'the sediments beneath the ocean floor in the Gulf of Thailand may be composed of rock containing high concentrations of mercury. Drilling and production operations can transport it to the surface as cinnabar or elemental mercury *(The Upstream Petroleum Industry of Thailand Task Force, 1993).* UNOCAL (1983) also reported that 'Elemental (metallic) mercury was not only regularly recovered from the cold separators and DPCU suction scrubbers on both the Satun and Platong 'CPPs'. It was also sighted at other points in the process from time to time. On occasions it was visible in solid waste removed from produced water skim tanks.

No mercury was present in the Erawan field until the recovery of elemental mercury from the flow line sample points on the Erawan 'WM' wellhead platform in July 1988. The appearance of elemental mercury at this location is consistent with the condensation phenomenon seen at DPCUs (and now expected at other pressures drop locations), in that the operation of the well head choke causes cooling of the gas stream by the Joule-Thomson effect.

During September-November 1985, UNOCAL set up a environmental work program on mercury investigation and monitoring which was made by consulting laboratories, Core lab and Geomet of the USA. The consultant carried out extensive sampling and analysis of sale gas, condensate, produced water and wellstream fluids to establish levels of mercury in all systems. Core lab results indicated that *mercury has been produced in all fields.* Mercury has been detected in all production fluids and also in solid wastes recovered from process vessels, storage tanks, piping and pipelines'. *(UNOCAL,1983).*

UNOCAL has a waste management plan that 'all of UNOCAL's stored hazardous waste materials will be re-injected into depleted offshore gas wells *(UNOCAL,1995).* The Upstream Petroleum Industry of Thailand Task Force (1993) pointed out that 'Petroleum drilling and production operations can transport mercury to the surface as cinnabar or elemental mercury. If released into the ocean with drill cuttings or discharged as produced water, it could possibly affect marine ecosystems, through fish and shellfish which, if eaten, can harm the consumer. Also it may condense during the production process which might have effects on the operation workers' *(Upstream Petroleum Industry of Thailand Task Force, 1993). (See detail about mercury problem management in MFD Environmental Investigation and Monitoring Project in Section 6).*

EIAs are not required by law in upstream oil & gas development in Thailand until January 1996. However, the oil companies have put high priority on environmental management, and make it a part in their corporate plan. Even without enforcement by any law, many offshore oil companies procedured some environmental reports such as; EIR report *(by Thai Shell Ltd., in 1990),* monitoring report *(by UNOCAL Ltd., in 1993),* EIA report *(by Total Ltd., in 1994),* IEE report *(Taipo Ltd., in 1995).* All of the environmental studies were prepared by Thai and/or overseas consultants. The reports recommended that there should not be harmful effects to the marine environment. The only observed impacts occur within 500-1000 meters *(the Report to DMR,1996).* However, oil spill impacts by case of accident might have harmful effects to coral, sea grass and mangrove ecosystems, and human uses such as aquaculture and fisheries.

However, regarding the mercury and heavy metals problem, UNOCAL has taken action with highest responsibility to protect the environment by including 'Mercury Contaminated Sludge Disposal' in one of the company Environmental Initiatives. An earlier Breakthrough Team Project resulted in a cost-efficient method of hazardous waste disposal from offshore operations. A waste management plan was initiated describing the handling transportation, storage and disposal or mercury-contaminated sludge. All of UNOCAL's stored hazardous waste materials will be re-injected into depleted offshore gas wells *(UNOCAL,1996).*

Beside, UNOCAL has made serious study of 'Alternative Technology', in an effort to utilize a more efficient system for removal of heavy metals and emulsified particulates from produced water and further evaluation of promising technologies is in progressing *(UNOCAL,1996).*

5.2 UK Oil & Gas Industry

5.2.1 UK Government' s Energy Policy

In the 1960s and 1970s the UK Government had policies which allowed oil companies to decide on commercial grounds how fast to proceed with development and production, based on **"good oilfield practice"** *(Eggar,1992).* The key objectives of the Government at that time were to ensure secure, diverse and sustainable supplies of energy in the form that people and businesses wanted and at competitive prices having regard to environmental implications. In 1992 the politics of the UK upstream petroleum industry were dominated by the UK Government's energy review and potential restructuring of the natural gas industry. The latter still remains the same today.

At present, the UK Government is still executing the same the energy policies. The Government believes that " this aim will best be achieved by means of competitive energy mergers working within a stable framework of law and regulation to protect health, safety, and the environment. ...." *(DTI,1996,Vol. 1).* The key objectives of the policy related to environmental protection are to have regard to the impact of the energy sector on the environment, including adopting policies and taking measures to meet international commitments, to safeguard health and safety *(DTI,1996, Vol. 1).* An assessment of the environmental impacts of using energy is needed to establish a basis on which to consider policies that may limit those impacts (one of the future targets reported in an annual UK White Papers on Sustainable development - public action plans covering the issues raised at Earth Summit held in Rio-) *(DTI,1996).*

5.2.2 Historical Overview

During the First World War when the oil became more important, the UK Government first began to consider the idea of encouraging companies to explore for petroleum. In 1918, the Petroleum

(Production) Act conferred on the Crown the right to control petroleum exploration and production in the UK and to grant licenses for that purpose. In 1934, the Act 1918 was repealed by the Petroleum (Production) Act 1934, while reaffirming the Crown's ownership, set out the framework to allow production. Four years later, an onshore gas field was found in Yorkshire *(DTI,1996, Vol.2)*, By the early 1960s, onshore oil fields were producing 150,000 tones per year *(DTI,1996, Vol.2)*.

Offshore exploration arose from a variety of reasons such as legal, technological, economic and international Continental Shelf agreement. After the Geneva Convention on the Law of the Sea,1958 established Continental Shelf rules, which gave countries with coastlines sovereign rights to explore and produce the natural resources in its Continental Shelf to a distance of 200 miles from shore. In 1964, the first licensing round, which divided the UK Continental Shelf into quadrants and blocks, began under the UK Continental Shelf Act,1964 *(DTI,1996, Vol.2)*.

In December 1965, the first significant discovery in UK waters was the West Sole gas field found by BP *(DTI,1996,Vol.2)* and it became the first gas field in production in March 1967 *(DTI,1996,Vol.2)*. In 1966 Amoco found the first oil in the Southern Basin, three years later the company discovered the first major oil field, Arbroath, with the first production in June 1975 from Hamilton Oil's Argyll Field *(DTI,1996, Vol.2)*. The very large Forties (BP) and Brent (Shell) discoveries also came into early production. Oil and gas development was controlled under the Board of Trade until the Second World War. This authority was transferred to the new Ministry of Supply, which was established in 1939. In 1942, the Ministry of Fuel and Power was set up (later became the Ministry of Power). Since in the 1960s, the Department of Trade and Industry (DTI) has taken over the responsibility *(DTI,1996,Vol.2)*.

Extending the Government's powers to control exploration, development and production, the British National Oil Corporation (BNOC) was established under the Petroleum and Submarine Pipelines Act 1975. In 1982, BNOC's exploration and production arm became privatized under the Oil and Gas (Enterprise) Act *(DTI,1996)*.

By the mid 1980s the UK had been largely self-sufficient in natural gas *(DTI,1996,Vol.2)*, Unfortunately, North Sea activity was overshadowed by the Piper Alpha tragedy in July 1988. In the following few years offshore production was reduced not only by the reason of the loss of Piper and shut-down of associated fields, but also by the fitting of equipment to improve a new offshore safety system. The UK now is a substantial exporter of crude oil and will remain a significant producer until well into the 1990's. However, oil prices weakened in the 1990s, thus the UK Government introduced the first out-of-round licensing awards in 1992 to facilitate early development of fields and sponsored a working party (*DTI,1996, Vol.2*). The DTI has sought generally to simplify regulatory requirements. A chronology of major UK Oil & Gas offshore Industry development is summarized in Table 5-3.

Table 5-3 UK Oil & Gas Industry Development.

1962	Seismic prospecting in the North Sea for natural gas and oil resources began
1964	Major Exploration activities started in UKCS (the Southern Basin Gas fields) after the enactment of the Continental Shelf Act 1964. The First well drilled in UK waters, 38/29-1 (Mid-North Sea High) no hydrocarbons discovered.
1965	The first productive gas well was found
1967	The first pipe-line to pump natural gas to the shore, at Easington in Yorkshire.
1969	The first discoveries of commercially viable quantities of oil in the Britain sector of the North Sea were the Montrose field.
1970	The first major find of oil in the British sector, in the Forties field.
1975	The first oil field in the UK sector to come on stream was Hamilton's Argyll field (the Northern North Sea). (Discovered in 1971). The first oil onshore was from the Argyll field.
1976	An initial flow averaging less than 250,000 barrels a day during the first full year of production
1980	The UK achieved net self-sufficiency in crude oil.
1984	The first gas sold to the public (British Gas Corporation) There was a statutory requirement to monitor the effects of discharging oil based drill mud cutting (only in terms of chemical contaminants)
1986	Britain had become the sixth largest producer in the world (The output of crude oil from the UK sector of the shelf averaged 2.5 million barrels (332,000 tones) per day.
1986	Offshore Natural Gas supplies met some 76.5% of the consumer market in the UK.
1991	The third highest level of drilling activity since exploration began.
1992	The first Out-of-Round Offshore awards was introduced.
1992/93	The first time evidence of their environmental policies was provided.
1993	The most dramatic recent events concern the UK Government's amendments of Petroleum Revenue Taxation in the March 1993.
1995	The DTI announced the introduction of Regulations to implement the EU Hydrocarbon Licensing Directive Regulations 1995, the Petroleum (Production) (Seaward Areas) (Amendment) Regulations 1995 and the Petroleum (Production) (Landward Areas) Regulations 1995 came into force. A single unitary landward License called Petroleum Exploration and Development License (PEDL) was introduced in 1995. it repealed the previous three license system (Exploration, Appraisal and Development Licenses).

5.2.3 UK Petroleum Licensing

Under the Petroleum (Production) Act 1934 all oil and gas found in the UK sector belongs to the Crown and gave the Crown the exclusive right of searching and boring for and getting such petroleum. By the Continental Shelf Act any rights with respect to the sea-bed and the sub-soil and their natural resources (excluding coal) exercisable by the Crown beyond territorial waters are also vested in the Crown. As far as petroleum is concerned, there are to be regulated by the Act 1934 (Sections 2, 3 and 6). Under the Act 1934, the Act 1964 and its associated regulations, the Department of Trade and Industry (DTI) on behalf of Secretary of State for Energy has powers to grant licenses for exploration and production of oil and gas fields within the United Kingdom (Landward Areas) and on the Continental Shelf (Seaward Areas). The licensing system is designed to promote good oilfield practice.

Seaward Areas : The Seaward Licenses are granted under the Petroleum (Production) (Seaward) Regulations 1988 permitted by DTI. For licensing purposes the UKCS is divided into areas called "Blocks" (about 250 sq.km./ Block) with 30 Blocks to a quadrant *(DTI,1996 ,Vol.2).* The seaward license are of two types: Exploration Licenses and Production licenses.

Seaward exploration licenses allow exploration, usually seismic surveying, Exploration wells drilled under these licenses may not exceed 350 m in depth without the approval of the Secretary of State. These licenses may be applied for at any time and are valid for three years. Seaward production licenses grant exclusive rights to holders to explore for and produce petroleum. These licenses can be applied for only in response to invitations, which are called "Rounds of Licensing" issued by the Secretary of State for Trade and Industry. In addition to the licensing rounds, under certain circumstances, the company may apply for blocks in between rounds, which are called "out-of-round applications) *(DTI,1996,Vol.2).* However, the licenses award system also involve with MAFF requirements to consult other interests such as The Ministry of Defense, Local Authorities; Crown Estates and British Coal *(Brennand,1990).*

Landward Areas : The oil & gas industry is regulated both by the Department of Trade and Industry (DTI)'s licensing procedure and including by the planning permission. The Landward

License are granted under the Petroleum (Production) (Landward) Regulations 1995 of the Petroleum (Production) Act 1934. There is only a single unitary landward License called Petroleum Exploration and Development License (PEDL). This PEDL has been introduced in 1995, it repealed the previous three license system (Exploration, Appraisal and Development Licenses, which were introduced in 1984) *(DTI,1996, Vol.2).* The rights granted by onshore licenses do not include any rights of entry onto land and the licensees must obtain the prior permission of the owners and occupiers of any land which they may wish to enter in connection with their operations *(DTI,1996, Vol.2).*

The Planning Permission System : The planning controls are defined in the Town and Country Planning Act 1971 and the Town and Country Planning Act 1972. To pursue any exploration, appraisal and development program the operator will have to apply for planning permission, which may granted by the Mineral Planning Authority (MPA). The planning is the responsibility of Local Authorities and also requires the permission from land owners and occupiers. Licensees wishing to enter or drill through coal seams must seek the permission of coal Authority *(DTI,1996, Vol.2).* However, temporary and transitory activities in exploration phase, such as seismic work, may not require planning permission. The public can influence mineral planing decisions at a variety of levels.

Outside the Planning System : However, Town and Country Planning controls do not operate in certain areas covered by the onshore licensing system. The award of a license does not remove the obligation to obtain planning permission where this is required under the Town & Country Planning legislation. Specifically, they do not operate in some estuaries below the low water mark and in certain areas of inshore waters included within 'Bay Closing Lines' (lines drawn across the mouth of estuaries). The onshore licensing system is applied out to the low water marks, except in estuaries. where it follows the 'bay closing lines' and on the west and the north coasts of Scotland.

There have been calls for "***no go areas***" as the Government recognizes " the exploration and development of hydrocarbon resources in these areas may give rise to strong environmental conflicts, in respect of wildlife habitats, amenity and tourist interests, as well as difficulties with navigation and fishery interests" *(Department of the Environment Circular 2/85; Welsh Office Circular 3/85; Scottish Development Department Circular 12/86) (Natural Conservancy Council, 1986).*

Before awarding the license, the Government consults MPAs and other interests. Oil-spill contingency plans are required in all cases, and in particularly sensitive areas, an EIA will be sought before consent for the development phase is granted. Production in an estuary, DTI asks Department of the Environment, Transport and the Regions (DETR) or the Scottish Development Department (SDD), or both in the case of border areas, to conduct a ***"Government View"*** procedure. During this process, the DETR or SDD will consult other Government Departments whose interests are likely to be affected, as well as the relevant mineral planning, pollution and coastal protection authorities. It also consults the statutory conservation bodies. On the basis of these consultations, the Secretary of State determines the government view on whether the purposed development is acceptable-and whether a license can be granted by DTI.

In June 1995, the DTI announced the introduction of Regulations to implement the EU Hydrocarbon Licensing Directive Regulations 1995, the petroleum (Production) (Seaward Areas) (Amendment) Regulations 1995 and the Petroleum (Production) (Landward Areas) Regulations 1995 which came into force on June, 1995 are designed expressly to extend to the UK the principles of transparency and non-discrimination to the award of licenses for oil and gas exploration as set out in the EU Directive *(Martyn,1996)*.

5.2.4 Current Licensing Rounds Awards

The most recently completed was the 16th in July 1995 (the first round was held in 1964). The 17th (Frontier) Seaward Licensing Round is now in progress. The 275 blocks in 68 trenches on offer in this Round were announced on 21 November 1995 and closing date on 27 November 1996 but this was put back to 25 March 1997. The first awards of Petroleum Exploration and Development Licenses were made in the 7th Landward Licensing Round, which was completed in march 1996. An 8th Round is now in progress and is expected to be completed in summer 1997. There were 144 landward licenses (149 at the end of 1995) in total covering an area of some

22,497 km^2 at the end of 1996, comparison with 1995 was 20,078 km^2 *(DTI,1997and DTI,1996, Vol.2).*

5.2.5 Out-of-Rounds Awards

Offshore Areas : The first out-of- round offshore awards, to facilitate exploitation of fields which merit early development was introduced in 1992 and was used in the first months of 1993. This new facility provided license production in advance of other awards under the Fourteenth Round for Blocks west of Shetlands, in a new area with great potential for major oil reserves *(DTI,1993)*.
Onshore Areas: There have only been 6 Exploration Licenses issued following Out-of-Round applications in 1993 *(DTI,1994).*

5.2.6 Block Condition licenses : Environmental Protection

The UK regulatory regime is enforced primarily through the licensing system. The DTI must hold widespread consultations with various interested groups, who will examine the environmental effects, before blocks in environmentally sensitive areas are offered for license. Where blocks in such areas are licensed, the conditions in the licenses will reflect the specific environmental concerns present. The license conditions are primarily concerned with good management practices throughout all stages in the life cycle of petroleum extraction. The principal requirement is for clear and detailed information to be made available to the relative bodies concerned, well in advance of the commencement of operations.

The extraction of petroleum and natural gas comes under 'Schedule 2' projects where developments require environmental assessment if they are likely to have significant effect on the environment (Environment Dept., Circular 15/88). The Act sets out the provisions of Environmental Statement that are to be undertaken and its subsequent publicity. This has however only been necessary in 2 cases, the Beatrice Field and the Liverpool Bay Lennox development.

The European Community Directive (OJL 175 5/7/85) makes arrangements for the implementation of project EIA on specific activities/developments. This was implemented in UK law through the

Town & Country Planning (Assessment of Environmental Effects) Regulations 1988 (Regulation 8) and subsequently duplicated specifically into the Environmental Assessment (Scotland) Regulations 1988. The final condition to be met prior to work commencing is to give 6 months notice to the local authority, allowing consultation on "oil spill contingency plans".

For area development near the coast, the licensee will normally be expected to carry out an environment impact study in preparing a development program for the Department. This study will be discuss with environmental bodies, local authorities, the National Rivers Authority and other users of the sea before any consent for production is given. The program will also have to include contingency plans, drawn up by the operator, to deal with possible oil spills.

Development on the Sea-bed may require the consent of the Crown Estates Commissioners, where there is work below the high-water mark in UK territorial waters or in a designated area. The operators will need the consent of the Secretary of State for Transport under the Coast Protection Act 1949 (Section 34), which may be granted subject to a condition that facilities are removed and the site cleared on the termination of the operations. The Secretary of State for Scotland may use his powers to designate certain sea areas within UK territorial waters within which operations involving the construction and assembly of offshore installations must be licensed by him (under Section 3 to 7 of the Offshore Petroleum Developments (Scotland) Act 1975).

Development in protected areas : A production license would not be permitted if it as located on protected areas suggested by the Royal Commission on Environmental Pollution. This idea, however, has been rejected by the Government.

The Secretary of State may either approve it, impose conditions upon it or reject it if -inter alias- that the carrying out of any of the proposals in it would be contrary to good oilfield practice, or that they are not in the national interest.

a) License Offshore Block Conditions - Notification

The model clauses for such licenses are taken from Schedule 4 to the Petroleum (Seaward Areas) Regulations 1988.

Seismic Survey **:** There are some controls on seismic activities such as restrictions on the activities in spawning season (July, August and September) , to reduce the mortality in the greatest biologically active periods. The main concern of license conditions is to provide consultation / notification of the DTI, MAFF and / or relevant regional agriculture and fisheries departments at least 28 days prior to work, as defined by CSON 37.

Drilling Site **:** requiring by CSON 10, to liaise with other bodies over information regarding location of any installations and their movements at all times. Under the Continental Shelf Act 1964 required to the interests of danger to navigation. The HM Coastguards should be notified with regards to movement and when in territorial waters or within international shipping routes the appropriate sea fisheries committee and shipping interests should be consulted respectively.

During Drilling **:** Well records before, during and on completion and sampling of well and the seabed are required under CSON 41. No drilling during spawning season (June and September) within the 3 mile zone and specific areas have been designed, that require prior written agreement before drilling can take place. However the most significant development over operational controls has been the requirement of **"Environmental Impact Assessment (EIA)"** to take place on nearshore site or those in close proximity to sensitive areas.

The 14th offshore licensing Round , announced on 1992, covered acreage in mature, less well explored and frontier areas respectively. The licensing had certainly focused activities on such sensitive areas. The environmental conditions will vary on a case by case consideration at each state in the licensing of E&P activities and will depend on DTI and other relevant Departments decisions for each block. However, there are main conditions for seismic/drilling which are required by DTI as follows ;

- No exploration and/or drilling may take place in specified part of the block. Co-ordinates available from DTI and will be stated in the offer letter.
- No drilling may be allowed in specified, highly sensitive zones such as an important seabird colony.
- Not more than one rig at any one time will be allowed to operate in any block or tranche of blocks.
- The licensee is required to consult the DTI, MAFF and / or relevant regional Agriculture and Fisheries Departments (i.e. SOAEFD; WO; DANI-FD), the DETR, CEC (also where relevant) and the JNCC at least 30 days prior to either undertaking any seismic survey or drilling exploration wells.
- All discharges will require the consent of the DTI.
- No drilling activities or operations involving discharges from the rig or pipelines, including any requiring consent under PSPA 1975, may be undertaken during a specified period by other relevant bodies.
- Water based muds must be used wherever technically possible.
- Licensees must agree in advance with DTI and other relevant Departments the formulation of muds (and any chemical additives) to be used in emergencies.
- All chemical used offshore and liable to be discharged must be consistent with the decisions made by the Paris Commission (or its successors).
- Reports on chemicals used must be made to the relevant Departments.
- Licensees may be required to dispose of all spent muds, cuttings and other discharges on shore, following consultation with DTI and other relevant Departments .
- Any discharges or zero use emissions from platforms may be to required to be monitored continuously.
- The licensee is required to consult the DTI and other relevant Departments on the proposed drilling mud system, disposal of drill mud and cuttings and discharge of chemicals if subsequent appraisal and development drilling is proposed.
- Licensees may be required to carry out seabed surveys in consultation with DTI and other relevant Department.

- The licensee is required to employ the best practicable means to prevent oil spillages and to consult DENv/ MAFF / SOAEFD / WO / DANI-FD, JNCC and DTI at least six month in advance and agree with them before drilling commences oil spill contingency plans.
- All oil spills must be cleared up immediately while there are in the vicinity of the platform unless otherwise agree with DTI and relevant bodies.
- All bulk fuel and oil base lubricants must be transferred by day and in good weather. In the most sensitive areas, transfers must also be made with the supply vessel at anchor and, where relevant, at slack water.
- Loading of oil at offshore terminals will not be allowed.
- Licensee is required to appoint a fisheries liaison officer and to agree suitable arrangements with seismic survey and supply vessel owners. Local Authority and Crown Estates Interests

The applicants must provide evidence of their environmental policies. In seeking licenses in these sensitive areas, operators undertook initial sensitivity analyses of the potential effects of proposed activities, and as some move forward into planning seismic exploratory activity, detailed consultations are getting underway. Once potential reserves are discovered the operator is now expected to undertake a detailed environmental assessment (EA) submission to the DTI. The exact requirements for such EAs have yet to develop. Full Environmental Impact Study (EISs) would be required for developments within 25 miles of the coast or in environmentally sensitive areas. The decision as to which blocks are sensitive are made by DTI, in consultation with other Government Departments and JNCC. In certain areas, Local Authorities might require EIS of developments.

The requirements for an onshore EIS are set out in the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 and the Transport and Works (Applications and Objectives Procedure) Rules 1992. Although these regulations do not apply for offshore, the EIS elements have been adopted by some local authorities as constituting the scope of what they believe is an acceptable EIS for an offshore development project.

The main elements of an EIS meeting onshore planning requirements are justification for the development, project description, description of the environment of the area, human activities and interests, impact assessment, mitigation of impacts, non-technical summary. For a new development project, an EIS should cover the construction and decommission and decommissioning/abandonment phases as well as the operational life of the installation. Although these regulations do not apply offshore, the EIS elements have been adopted by some local authorities as constituting the scope of what they believe is an acceptable EIS for an offshore development project.

The 16th offshore licensing Round have been held in late 1994, some of the blocks are in environmentally sensitive areas. The licenses have strict conditions attached to protect the environment. This is the first round in which all applicants had access to a common environmental database (DTI,1996,Vol.1). Any potential adverse impact on the environment must be identified and steps taken to avoid or minimize risks. The recently offshore Round, 17th, for all blocks on offer will be subject to conditions to protect other marine interests, including environmental sensitivities.

5.2.7 Onshore Conditions License

The conditions under which a license is granted for exploration onshore include the following :

- There is no guarantee that the site will be available for drilling even if resources are found;
- No drilling can take place in the intertidal zone;
- There must be consultation with fisheries interest, the Nature Conservancy Councils and the Ministry of Defense;
- Water -based muds must be disposed of on land;
- The Department of Environment must examine the development plan.

5.2.8 Production activities

In 1991 United Kingdom was the 7th largest producer of natural gas in the world, producing 2% of world output, or about 58 billion cu.m from total world 2, 514 Bcm (The USSR (34%) was the top producer, followed by the USA (24%), Canada (5%), Algeria (5%), Netherlands (3%), Indonesia

(2%) *(Homer, 1993)*. The UK with its large scale offshore oil & gas industry approximately 150 platforms *(Gore,1994)*.

In 1995, the DTI (1996) reported the highest annual oil production in UK ever at 130 million tones, including 8,533 thousand tones of natural gas liquids (a rise of 3% on 1994) *(DTI,1996, Vol.2)*. Oil producing rate was 319.8 thousands of tone/day compared with 313.4 in 1994 *(DTI,1996, Vol.2)*. Gas production rose for the sixth successive year at 75 billion cubic metres (or 2.66 trillion cubic feet) (a rise of 8% on 1994). Oil and gas production in 1995 accounted for some 2% of the UK's GDP, total income of the oil and gas production sector being about 17.9 billion Pound Sterling *(DTI,1996, Vol.2)*.

Petroleum fields : As at March 1996, there were 101 oil fields (81 offshore, 20 onshore) compared with 93 at March 1995, and 68 gas fields (62 offshore, 6 onshore) compared with 56 at March 1995. Twenty six new fields (16 oil, 8 gas, and 2 condensate) were approved, the highest ever in one year. For the second year in the row, 261 development wells (including sidetracks) (at March 1996 - 244 wells) were drilled at offshore and onshore 28 new development wells (at March 1996 - 19 wells).

5.2.9 Exploration activities`

Offshore : In 1996, 112 wells were drilled (98 wells - in 1995). These comprised 72 exploration (60 wells- in 1995) and 40 appraisal (38 wells- in 1995), including Sidetracks; 10 in total (19 in 1996). Exploration drilling activity during 1996 was at the highest level for 4 years. Eleven significant (7- in 1995) (a test flow rate of more than 1,000 BOPD for oil, or 15 MMSCFPD for gas) discoveries have been announced *(DTI, 1996, Vol.2)*.

Onshore : Six exploration wells and one appraisal wells were commenced in 1996, comparison with only three exploration wells were drilled and no appraisal drilling in 1995 *(DTI,1996, Vol.2 and DTI, 1997)*.

Success Ratio Discoveries : The average success ratio of significant discoveries to exploration targets drilled in 1992 has been at the ratio of 1:5 *(Eggar, 1992).* During 1992 and 1993, exploration success increased to the same rate of around 1: 4 *(DTI, 1993 and DTI,1994).* The average discovery rate has remained at about 1:6 (significant discoveries and commercial fields only per exploration well) which was reported by Parley (1990). Nor is there any sign of this success level reducing, though size of discoveries is of course generally smaller than in the earlier years. Indeed an increasing proportion of these discoveries are now becoming economic to develop as infrastructure expands and use of new and cheaper technology increases.

5.2.10 Development Drilling Activities

Offshore : During 1995, 244 development wells (including 42 sidetracks) were drilled. DTI pointed out that this is the highest number started in any year since drilling began on the UKCS in 1964 *(DTI,1996, Vol.2).* **Onshore :** DTI (1996) reported that development drilling levels in 1995 were doubled with 19 development wells spuded *(DTI,1996, Vol. 2).*

5.2.11 Pipeline Activities

Offshore : A the present time there are well in excess of 4800 km of pipelines which have been laid by the oil & gas industry in the waters of the North Sea and these comprise a mixture of large diameter trunk lines, smaller pipelines, inter-field lines and flow lines, with some trenched or buried and others not, so that in spite of the undertakings of the early days that there would be no proliferation of pipelines. This most certainly is present in the shape of a picture resembling a '***Spaghetti Junction*** ' *(Buchan et al, 1992).* During 1995, there were 31 submarine pipeline works authorizations for the construction and use of 133 additional submarine pipelines in North Sea (UK sector) *(DTI,1996,Vol.2).* **Onshore :** Only one cross-country pipeline commissioned during 1995 and two pipeline construction authorizations were issued *(DTI, 1996, Vol.2)* .

5.2.12 Operational Discharges and Oil Spills

The main areas of concern about the effect of E&P operations on the environment are usually the possibility of oil spills, gas flaring and discharges from offshore installations.

a) Hydrocarbon Input

In 1980 total hydrocarbon input from offshore operation as a small and less than 2% input to the North Sea (*Read and Blackman, 1980*) and increased at between 14 and 21% in 1986 (*Bedbourgh and Blackman, 1986*). The discharges of oil from UK installations have increased from representing 72% of the total discharges to Convention Waters in 1986 to 84% in 1989 (*PARCOM, 1991*). Since the late 1960s when oil and gas exploration and production in the North Sea started, a large number of wells have been drilled, using diesel based drilling muds (up to 1985), (low aromatic) oil-based muds , and water based muds

In 1991 the total discharge of oil from offshore installations in UK waters (including the Irish Sea) was 14, 300 tones, of which 9, 400 tones were contaminated in oil-based mud cuttings (most of this oil remains on the seabed with the cuttings), 4,700 tones were discharged with produced water and 200 tones were the result of spills (*Doody ,1993*).

b) Produced Water Discharged

The total weight of oil discharged with produced water in 1995 from 55 installation was 5,855 tones in 192 million tones of total produced water *(DTI,1996,Vol.2).* Produced water discharged during 1986-1995 is shown in Table 5 - 4. Until 1990, the average oil content of the discharged water had remained reasonably constant over the years, despite the increase in the amount of water being produced.

c) Oil Discharged on Drilling Cuttings

Up to 1992, UK is the biggest oil and gas producing nation in the North Sea and as a result accounts for over 90% of the oil discharged into the sea through drilling activity (*Davies,1992*). The disposal of oil drill cuttings at the site of drilling has now virtually ceased in the Norwegian sector, and only the UK still permits the disposal of such cutting on site (due to cease in 1994 for exploration wells and in 1997 for all wells, in accordance with the Paris Commission guidelines). Nevertheless it has been estimated that up to 2% of the seabed of the total North Sea has been affected by oiled drill cuttings, i.e., oil is detectable in the sediments and /or there have been changes in the species present. In 1995, amount of oil discharged on drilling cuttings from 94 wells drilled using oil-based mud (342- total wells drilled) was 3180 million tones *(DTI,1996, Vol.2).* See detail in Table 5 - 5.

d) Gas flaring:

During 1995 an average of 6.27 million cu. metres (or 224.18 million cu.ft) of gas a day was flared at offshore installations, which produced 319.8 thousands of tones/ day of oil *(DTI,1996, Vol.2).* It is only over 5% from the flaring in 1994 *(DTI,1996,Vol.2).* Flaring at onshore operations was minimal compared with offshore. The gas flared during 1988-1995 is shown in Table 5 -6.

e) Oil Spills:

In 1995, DTI (1996) reported that there were 145 oil spills, which contributed 84 tonnes of oil *(DTI,1996, Vol.2).* This number of spills was similar to the figure for 1994. In any case, of the tonnage of oil spilt, there was an over 50% decrease compared to 1994 and less than 8% of the total number of spills were more than 1 tonne *(DTI,1996, Vol.2).* The number of oil spills during 1986-1995 is shown in Table 5 - 7.

In 1996, the total volume of oil reported as spilt was at its second lowest level for the past 10 years, with no spill over 20 tonnes- in fact 92% of reports were for spills of less than 1 tonnes *(DTI,1997).* In addition to the self reporting system the DTI carried out over 300 hrs. of unannounced aerial surveillance monitoring of offshore oil and gas installations and carried out a number of offshore inspections.

Table 5 - 4 Oil Discharged with Produced Water during 1986-1995, UK *(DTI,1996, Vol.2)*

	1986 (1)	1987 (1)	1988	1989	1990	1991	1992	1993	1994	1995
Number of installations permitted to discharge oil	34	34	36	36	39	39	43	46	52	55
Total oil (tones)	2710	3330	3234	3423	4393	5490	4850	4232	4418	5855
Total water (million tones) (1)	94	114	123	106	159	153	135	148	147	192

Note : (1) This includes storage displacement water amounting to 18 million tones for 1986 and decreasing to 14 million in 1987. In 1988 the figures rose to 17 million tones. Storage displacement water contains typically less than 10 ppm of oil.

Table 5 - 5 Oil Discharged on Drill Cuttings during 1986-1995 (million tones)

	1986	1987[1]	1988	1989[1]	1990[1]	1991	1992	1993[1]	1994	1995
Wells drilled	198	258	345	337	348	333	372	288	309	342
Wells drilled using oil-based mud	139	176	252	266[2]	260[3]	249[4]	196[5]	150[6]	102[7]	94[8]
Oil discharged	13000	12400	18500	13400	12310	11230	7169	4588	3820	3180

Note : Sidetrack wells are included as separate wells from 1989 onwards. *(DTI,1996, Vol.2)*

1 - figures vary from those in previous Brown Books.

2 - Includes 6 wells spudded in 1988 but which did not used oil-based mud until 1989.

3 - Includes 20 wells spudded in 1989 but which did not used oil-based mud until 1990.

4 - Includes 22 wells spudded in 1990 but which did not used oil-based mud until 1991.

5 - Includes 20 wells spudded in 1991 but which did not used oil-based mud until 1992.

6 - Includes 16 wells spudded in 1992 but which did not used oil-based mud until 1993

7 - Includes 12 wells spudded in 1993 but which did not used oil-based mud until 1994

8 - Includes 6 wells spudded in 1994 but which did not used oil-based mud until 1995

Table 5-6 Oil produced and gas flared at offshore producing oil fields. *(DTI,1996,Vol.2)*

	1988	1989	1990	1991	1992	1993	1994	1995
Gas Flared[1]	6.1	6.5	7.1	6.5	6.8	6.7	8.8	6.27
Oil Produced[2]	297	237.5	236.3	227.7	233.3	247.1	313.4[3]	319.8

Note : [1] Millions of cubic metres/day, [2] Thousands of tones/day, [3] Figure in last years chart revised.

Table 5-7 Sources of Oil Spills during 1986-1995(*DTI,1996, Vol.2)*

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total Number	166	254	259	291	345	234	194	183	147	145
oil based mud spills[1]				326[5]	466[6]	116	49	145	74	29
other oil spills[1]				191	423	76	176	79	100	55
Total amount*	3540[1]	516[3]	2627[4]	517	899	192	225[7]	224	174	84[8]
reported spills**	36	39	44	44	56	39	43	43	50	52
offshore oilfields***	121	117	109	87	86.3	83	89	90	114.4	117

NB : * tones, ** No. of Installations, *** Total stabilized crude oil produced (million tones)

Note : 1 - Figures not available for years prior to 1989.

2 - Includes one spill of 3000 tones and six spills of over 25 tones.

3 - Includes one spill of 80 tones, one spill of 64 tones, one spill of 35 tones.

4 - Includes one spill of 1500 tones, one of 750 tones and one of 35 tones.

5 - Includes one spill of 93 tones and one Of 45 tones.

6 - Includes two spills of 80 tones and one of 62 tones.

7 - Includes one spill of 20 tones and one of 38 tones.

8 - Includes one spill of 22 tones and one of 25 tones.

5.2.13 Reserves of UK Oil and Gas

The initial recoverable proven reserves have increased significantly, largely as a result of the development plans for 16 new oil, 8 new offshore gas fields and 2 new gas-condensate fields being approved in during 1995 *(DTI,1996,Vol.2).*

Oil reserves : Total initially recoverable reserves are estimated to lie in the range of 3640-8630 million tones. The reserves include 2520-3805 (discovered), 130-340 (potential additional reserves), 990-4485 (undiscovered) *(DTI,1996, Vol.2)* .

Gas reserves : Total initially recoverable reserves are estimated to lie in the range of 2285 - 4717 bcm. The reserves include 1750-2965 (discovered), 140-340 (potential additional reserves), 395-1412 (undiscovered) *(DTI,1996, Vol.2).*

At the end of 1995, DTI (1996) reported that the reserves remaining (proven, probable, and possible) were 1,890 million tones for oil (compared with 2,075 million tones at the end of 1994) and 1,915 billion cubic metres for gas (same as 1994) *(DTI, 1996,Vol.1).*

5.2.14 Environmental Impacts

Oil Based Muds : The total area of major biological effects in the UKCS is approximately 106 sq.km or 0.04% of the UKCS total area. In comparison, the area affected by one fly-ash dumping ground in the North Sea is 43 sq.km. In the immediate vicinity of the discharge point this effect is at least one of a smothering effect on the natural environment. However this smothering effect is very localized i.e. not far out from the platforms. Serious effects on macrobenthic community structure within the sediment were found within 1 km distance from the platforms, with only a few species being able to survive at the closest sites although large numbers of them were often present. Beyond 1 km distance the species diversity increased rapidly with only subtle effects seen out to about 3 km distance where the hydrocarbon levels were only 2-3 times *(CEMP(1),1996).*

To assess the effect of the oil-contaminated drill cuttings monitoring programmes have been carried out by government and industry on the seabed around platforms since the late 1970's. The result show that there are very steep hydrocarbon gradients (with 1 km distance) around those platforms using OBMs, with higher than background levels extending to about 3 km distance, and contamination detectable out to 5-8 km distance in the direction off the predominant bottom current *(CEMP(1),1996).*

Produced Water : The effect of produced water on the North Sea as a whole are next to nothing. There are no evidence of any detrimental effect on marine organisms from produced water. The no Effects Concentration is reached very soon after discharge and the impact can be considered to be non-existent.

Spills : The history of the E&P Industry in the North Sea is excellent with respect to the low number of spills (less than 1%) which have occurred. Taking into account the rapid weathering of this oil is evident that this source of oil spill has little impact on the receiving environment. The actual effect of spilled oil depends largely on the quantity spilled. Gross spillage's have the potential to cause much harm through the effect on all surface dwelling (e.g. birds) and surface dependent species.

Atmospheric Emission : The offshore industry cannot function without emitting gases which are of global concern. Their amount is not large compared to those emitted in total from all other sources in the UK.

SUMMARY

THAILAND

Early petroleum exploration was conducted by the government. In 1954 Thailand changed her attitude by allowing private sectors to engage in petroleum exploration and production. Since the late 1950s, small quantities of oil have been produced in the Government reserve onshore area at Fang. Onshore exploration activities started in earnest in 1970. Before the early 1970s, very little exploration work was carried out in Thailand. However, since then there has been considerable activity, mostly offshore. The exploration offshore has been concentrated in the Gulf of Thailand, where UNOCAL has found significant gas reserves. Thailand has proven offshore reserves of natural gas in the Gulf in commercially exploitable fields.

In addition to the Gulf, the other area to see exploration activity offshore is the Andaman Sea, although to date no significant discoveries have been made in this area. Only 13 wells were drilled in the Andaman Sea compared to 1038 wells in the Gulf of Thailand.

From then up to the present, a total of 15 rounds of concession bidding have been announced. Up to the end of 1995, the total number of wells drilled in Thailand was 1,344 wells and a total of 42 fields were discovered. The petroleum production rate was 240,000 BBPD in 1994. The total ultimate oil and condense reserves are 491 and 494 MMBBL, respectively, while the total ultimate gas reserve is 17.6 TCF (as of January 1995). Approximately 15 % of gas, 18% of oil and 17% of condensate reserves have so far been produced.

The search for oil has not been encouraging, and there is only minor production in Thailand. Thus oil remains a major import item. Due to increasing demand for energy in the country, Thai government has continued to promote petroleum exploration and production, especially wishing to attract international oil companies.

THE UNITED KINGDOM

The UK government has set four main issues in their energy policy to ensure about the full recovery of economic hydrocarbon reserves, adequate and competitive pipeline provision (considerations on a case by case basis), facilitate communications (the government will be sensitive to issues of commercial a confidentiality, and take proper account of environmental issues.

The main oil & gas activities in the UK are in North Sea, with other major developments occurring now in the West Shetland Basin. In the United Kingdom the Crown has rights to all gas and oil found within the UK sector and licenses for oil and gas exploration and production have been issued by the Department of Trade and Industry (DTI) in phases called "rounds". Onshore oil discoveries have been small compared to offshore oil & gas fields. Onshore developments require, in addition to a development license, planning permission from the Local Planning Authority and permission from landowners and occupiers.

In 1995 a total of 97 exploration and appraisal wells were drilled in UK, a total of 130.3 million tones of oil and a total of 75.3 billion cubic metres of gas were produced. These production accounted for some 2% of the UK's GDP and total income of this sector in 1995 was 17.9 billion Pound Sterling. As at 1995 possible remaining reserves of oil and gas are estimated at 1,890 million tones, and 1,915 billion cubic metres, respectively.

Section 6

A CLOSER EXAMINATION OF ENVIRONMENTAL LEGISLATIVE & INSTITUTIONAL FRAMEWORK EFFECT ON THE OIL & GAS INDUSTRY IN THAILAND

6.1 Introduction

The aim of this Section is to review and summarise the key features of the current situation of environmental regulatory frameworks (Legislative and direct and relevant government authorities) regarding upstream oil & gas activitities in Thailand.

6. 2 Development of Environmental Policy in Thailand

Despite very rapid economic growth, Thailand's serious environmental issues are still not being voiced by an environmental movement that is anything more than embryonic. Thailand, like most countries in the region, still lacks strong environmental institutions capable of formulating and implementing policy. The situation is made worse by jurisdictional complexity, insufficient information, poor analytical frameworks for this information, inadequate enforcement, and low level of participation and awareness from the private sector, general public, and other interest groups. Institutional capabilities and scientific knowledge often tend to be poorly reflected by regulations, standards, and guidelines. Levels of public awareness are very low. Only basic laws now exist for air and water quality, and hazardous waste management. The provisions are as yet neither complex nor extensive. The National Environment Board (NEB), created in 1975, has been increasingly criticized as an ineffectual 'paper tiger', as have the governing statutes.

The first act of parliament addressing environmental issues was the National Environmental Quality Act 1975, under which the NEB and the Office of the NEB (ONEB) were established. A national environmental program was thus developed. In the past few decades, the method of ***Environmental Impact Assessment (EIA)*** has proved itself to be one of the most useful management tools for the development projects. Since the mid-1970s, ESCAP has conducted many activities focusing on the promotion of EIA and its use in the ESCAP region *(United Nation, 1990).*

During that time, many counties have established legislative systems on EIA. In 1977 the EIA process was in use in Thailand, but despite long experience there are still problems with its application. However, several constraints on the method and the systems have revealed themselves, including lack of adequate environmental information, shortage of skilled manpower and lack of access to the latest EIA methodologies. In the late 1980s it was recognized that the existing legal framework was inadequate *(Snidvongs, 1995)* ,and in 1992 the law was overhauled with the promulgation of the Enhancement and Conservation of the National Environmental Quality Act.

6. 3 Thailand Environmental Policies

'Environmental Impact Assessment (EIA)' and 'Planning' are the most important *policy instruments* available to Thailand's environmental management policy. Environmental planning in Thailand has been divided into two levels:

(i) Micro-level : Emphasis is on the project level, including EIA management in order to link natural resource utilization with protection.

(ii) Macro-level : This is classified into two levels:

a. Sectoral planning, including land use, agriculture, industry and human settlements;

b. Area planning, by integrating environmental planning into socio-economic development plans.

The Environmental Quality Act (1992) is still inadequate to accomplish its share of the Bruntland goal of developing country sustainability. There needs to be

- establishment of a new Ministry of the Environment;
- the above ministry should enjoy similar powers to the present one, but with 'more realistic' resources;
- setting up of competent environmental units in the planning divisions of implementing agencies;
- improved setting and enforcement of standards; provisions for more effective use of the private sector within environmental action programs;
- detailed sector-specific environmental management handbooks for planners and managers

*(**Source:** the Report to DMR,1996)*

However, the environmental policy of Thailand is affected by International Treaties and Conventions. Currently ASEAN nations, including Thailand, have participated in several international agreements, conventions and treaties on the environment, including some of the following : The MARPOL Conventions, 1973 and 1978, the Convention on the Law of the Sea 1982, the Vienna Convention for the Protection of the Ozone Layer 1985, the Montreal Protocol on Substances that Deplete the Ozone Layer 1987, the Basle Convention on the Transboundary Movement of Hazardous Wastes. These international agreements will continue to assist in shaping evolving policies on environmental protection efforts of Thailand and ASEAN nations.

ISO 14,000 : The ISO 14,000 and TC 207 certification standards may be implemented in the very near future where laws do not as yet exist in most ASEAN countries such as eco-labeling. However, compliance, enforcement and strategic policy developments covering the subjects also covered by these standards may pose significant legislative issues in the future.

6. 4 Environmental Planning Intregrated into Development Planning

The Thai provisions for environmental management are still fundamental. Thailand's regulatory mechanism on the policy consists of three main components :

- policy as prescribed in the National Economic and Social Development Plan;
- policy as addressed by the government to the House of Representatives; and
- policy of the Ministers.

6.4.1 The National Economic and Social Development Plan

The Thai government has tried to address solutions to upgrading the quality of life through efficient environmental and natural resources management.

The Fourth Plan *(1977-1981)* devoted attention to ***"Environmental Development"***, in which causes and problems of environmental issues as well as short-term and long-term development measures are elaborated.

The Fifth Plan *(1982-1986)* gave increased attention to environmental considerations. Its content dealt with four major environmental problem areas: environmental pollution, natural resource deterioration, ecological change, and urban growth, with an analysis of existing problems and future trends, including strategies in implementation.

The Sixth Plan *(1987-1991)* included a master plan for natural resources and the environment with four basic components:

(I) Information management and monitoring of natural resources and environment;

(ii) Legislative development of natural resources and environment development;

(iii) Institutional development of natural resources and environmental development; and

(iv) Strengthening co-operative efforts in natural resources and environmental development.

The Seventh Plan *(1992-1996)* According to the rapid growth in energy consumption and environmental impact, the government must put more effort in energy conservation and environmental preservation in the Seventh plan. Major emphasis of the Seventh Plan is placed on balance in all facets of development. The Seventh plan bears a striking resemblance to the Sixth, as in the following guidelines.

- to acquire sufficient energy, from domestic sources and imports, at suitable prices, to meet demand;
- to emphasize efficient and economic use of energy;
- to expand the role of the private sector and stress unification of the public sector in energy administration;
- to spread progress to rural areas and new economic zones;
- to stress the importance of environmental preservation.

Development and environmental quality go hand in hand with national economic and social development by emphasizing development management mechanisms to deal with pollution problems in water, air, solid and hazardous wastes in a more efficient manner in the following ways.

1. Enforce the **"polluter-pays-principle"** during the Seventh Plan period.

2. **Improve organization**, role and legal framework to improve efficiency in environmental management, The local authorities should have flexibility to manage the treatment services and empowered to collect service charges as appropriate.

3. Mobilize investment for **reduction and control of pollution** in various forms. The government may invest or carry out joint investment, or grant a concession to the private sector for the provision of a central hazardous wastes disposal system for industrial plants, etc.

4. The government should **join forces with the private sector**, communities, and the people in the protection, prevention and solution of environmental problems.

(Source: The National Economic and Social Development Board,1991).

6.4.2 The Five-Year Environmental Quality Policy and Plan

The preliminary draft of the Five-Year Eighth (from 1997-2001) Plan concerning energy resources can be summaries as shown in Table 6-1

Table 6-1 The Major Goals and Directions of The Five-Year (1997-2001) Plan concerning energy resources.

Goals	Directions	Operational Plans
1. To promote the development and production of energy resources to meet domestic demand, giving due regard to conservation and protection of a natural balance. 2. to keep imported energy dependency at an appropriate level. 3. To promote efficient use of energy	To prevent environmental pollution from • drilling of oil and • natural gas, • production of oil • and natural gas, • onshore and offshore oil transportation • oil spills	1. To accelerate the exploration and development of petroleum fields. 2. To minimize environmental impacts

(Source: Adapted from Taranajesda,1996)

6.4.3 The 20-Year Environmental Quality Policy and Plan

MOSTE has set the directions for the development and rehabilitation of natural resources and the environment for the next 20 years (from 1997- 2016) into the Five Year-Plan as above. The 20-Year Plan consists of six major policies as follow; Natural Resources, Pollution Management, Natural and Cultural Source Conservation, Community Environment and Green Areas Management, Environmental Education and Public Relations on Environmental Awareness, and Environmental Technology Management.

Natural Resources Policy : the policy covers land resources and development, forestry, water, minerals, coastal and energy resources.

Energy Resources Policy : Major goals and Policies of the 20-Year Policy and Plan concerning *energy resources* are shown in Table 6-2 below :

Table 6- 2 The Major Goals and Policies of The 20-Year Policy and Plan concerning energy resources

Policies	Goals	Operational Procedures
. To promote the development and production of energy resources to meet domestic demand, giving due regard to conservation and the protection of natural balance. . To promote efficient energy use.	1. To promote judicious and efficient use of energy resources and also maintain a natural balance. 2. To develop and acquire energy sources to meet the demand. 3. To develop the production and utilization of technology in judicious and efficient ways and to minimize pollutants.	. To accelerate the exploration and development of energy resources. . To use them to their maximum extent while environmental quality is protected.

*(**Source:** Adapted from Taranajesda,1996)*

6. 5 The Current Environmental Problems in Thailand

The main environmental problems current in Thailand are water pollution, air pollution and solid waste.

Water Pollution : Deteriorating water quality, brought about by the discharge of industrial wastewater into rivers and streams, has become a serious environmental concern. The major polluting industries are food, brewery, pulp and paper, rubber, and tanneries. In 1991, it was estimated that about 525 thousand tones of Biochemical Oxygen Demand (BOD) were discharged without any treatment. However, the average of untreated wastes is only 30% of the total industrial wastewater which of this, about 9% is from petroleum-related products.

Air pollution : At present, Thailand, Bangkok, suffers from industrial air pollution and vehicle pollution, but this is not so severe in the rural areas. The causes are from rapid industrial development, increasing utilization of natural resources, and growing urban populations. The major sources are from transportation, industry and power generation. The main pollutants in the atmospheric are sulfur dioxide, nitrogen dioxide, atmospheric lead, smoke and suspended particulate matter. About 64% of total No_x emissions in Thailand are caused by the transport sector.

Solid Wastes : The dumping of hazardous wastes is becoming a problem of great concern. In 1991, approximately 2 million tones of hazardous wastes were from the industrial sector which are becoming an acute problem, due to either a lack of treatment or ineffective treatment for substances such as toxic chemicals and heavy metal pollutants. The volume of such waste is expected to grow at an annual rate of 9%. Many factories dump the wastes on their own premises and many small factories simply dump their waste directly into the river. However, there is now a requirement for all land fill sites to obtain a license prior to entering operation.

6. 6 Government Agencies Which Affect the E&P Industry

There are at least five Ministries related with environmental tasks as follow;

- Ministry of Science Technology & Environment (MOSTE)
- Ministry of Industry (MoI)
- Ministry of Transport & Communications (MoTC)
- Ministry of Public Health (MoPH)
- Ministry of Commerce(MoC)

See the Ministries and environmental framework in Fig. 6-1.

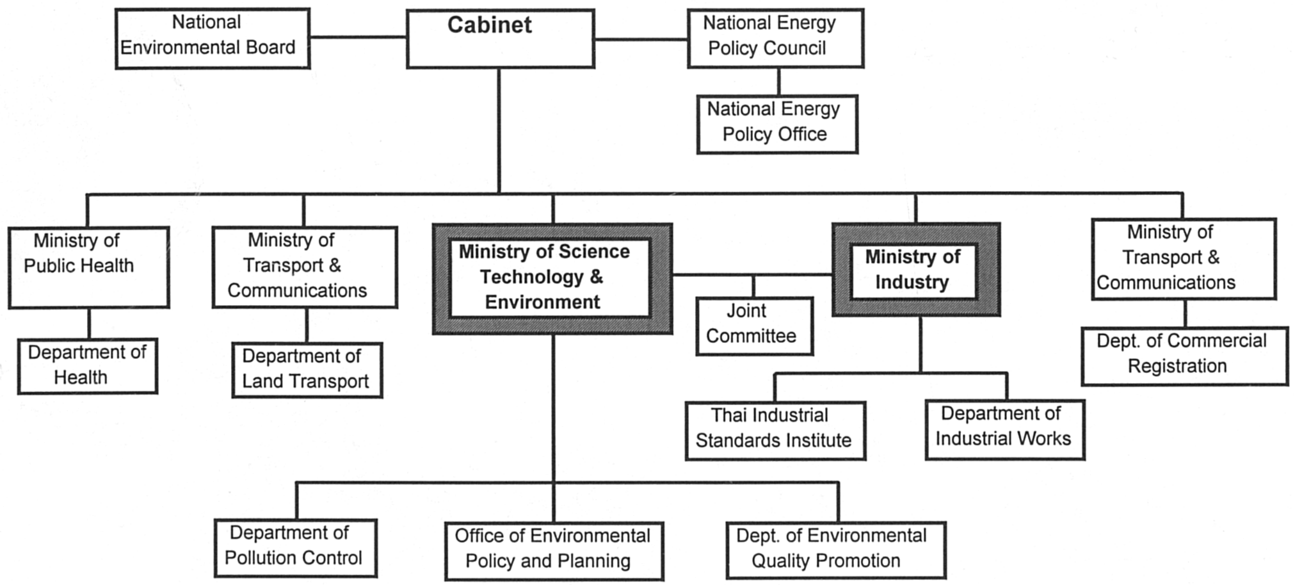


Fig.6- 1 Ministries with Environmental Tasks *(Source : UNOCAL Thailand Ltd., 1994)*

6.6.1 The National Environmental Board (NEB)

The NEB was formed to coordinate environmental protection which falls under various government bodies and ministries. The Board in existence is at a high level of authority with the Prime Minister as Chairman, and transfers its responsibility of operation for carrying out Board Policy decisions to the New Ministry of Sciences Technology and Environment (MOSTE). The NEB determines which development projects require an EIA.

6.6.2 The Ministry of Science, Technology and the Environment (MOSTE)

The MOSTE is primarily responsible for environmental protection in Thailand. The Ministry is responsible for issuing Ministerial Regulations, Fixing fees, appointing pollution control officials, and other matters. However, the MOSTE, and the Ministry of Interior are both also significantly involved in developing Ministerial Regulations to address environmental issues. In addition, the Industrial Estate Authority of Thailand supervises some of the many industrial estates in the country, and the Authority has issued specific water quality standards and requirements for facilities located on estates supervised by the Authority.

In 1992, Thai Government placed environmental enhancement as one of the principle objectives of the Seventh Development Plan (1992-1996) which resulted in the creation of the Enhancement and Conservation of National Environmental Board with three new agencies which have an environmental mandate under MOSTE: the Office of Environmental Policy and Planning (OEPP), the Pollution Control Department (PCD), and the Environmental Quality Promotion Department (EQPD). Environmental Departments are shown in Fig. 6-2.

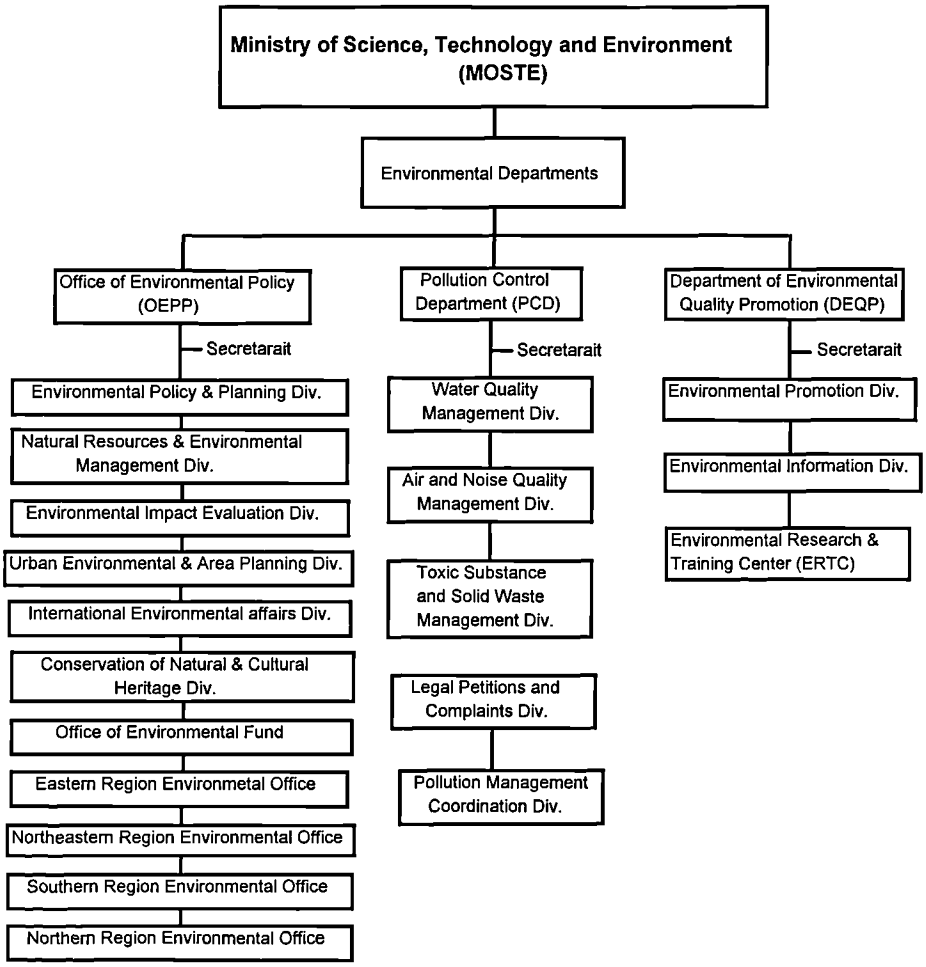


Fig. 6-2 New Environmental Departments in Thailand *(DEQP,1993:4)*

1) The Office of Environmental Policy and Planning (OEPP) : The OEPP is responsible for developing national environmental policies and planning and establishing ambient environmental standards and preparation, review, and approval of environmental documents and EISs for specified project categories. The office provides the work plans and guidance concerning the management of air, water, pollution control, and enactment of environmental laws and regulations.

2) The Pollution Control Department (PCD) : The PCD is responsible for regulation of pollutant levels, setting emission and effluent standards and coordinating government agencies, state enterprises and private sector in their actions to control, prevent, mitigate or eradicate pollution, and investigation of non-compliance with regulations.

3) The Department of Environmental Quality Promotion (EQPD) : The EQPD is responsible for research, promotion and training to conserve the environment. It also advises point-source dischargers/ emitters about import duties and technical expertise on pollution control.

6.6.3 The Ministry of Industry (MoI)

The MoI is the key Ministry which is directly responsibility for E&P activities. However, other Ministries may be relevant to upstream oil and gas development, including air emission standards, noise levels, coastal and surface water quality standards, solid waste and hazardous waste standards, groundwater standards and monitoring.

Besides this, there are a joint committee (Sub-Committee on Environmental and Industrial Management Co-operation) between MOSTE and MOI, meeting monthly since 1993, which oversees environmental matters that fall within MOI's scope. The other agencies which are related to environmental management include : Office of National Economic and Social Development Board (NESDB), Industrial Works Department (IWD), Department of Health (DOH), Royal Forest

Department (RFD), Industrial Estate Authority of Thailand (IEAT), Department of Agriculture (DOA), National Safety Council of Thailand (NCST), Department of Public Cleaning (DPC)

6. 7 Key Institutions Concerned with E&P Activities in Thailand

6.7.1 Department of Mineral Resources (DMR)

1) History

The Department of Mineral Resources *(DMR)* was established on 1st January 1891. It was first named the Royal Department Mines and Geology. In its early stage, the Department was responsible for development and exploration of the Kingdom's mineral resources, including metallurgy and geography. In 1933, his name was changed to the Royal Department of Mines. In 1942, upon the establishment of the Ministry of Industry, the Department then came under this Ministry. The responsibilities and scope of services have expanded to cover all major functions combined with mineral resources including petroleum and ground water. The Department changed its name again in 1963 to the DMR.

2) Current Structure and Functions

DMR administration structure can divided in two systems, Central Administration (comprises of 16 functional divisions, one central office and three regional offices) and regional administration (26 provincial offices). At present, employees of the Department number about 4,600 officers. DMR is dischanging its works budgeting at a minimum of one billion Baht each year (£1= Baht 43, average in 1997).

On its legal functions, DMR grants prospecting licenses, mining leases, and licenses for withdrawing underground water. DMR is responsible for supervising mineral resources exploration and production activities in accordance with the terms of the concessions. The functions, moreover, involve the enforcement of Mining laws, Petroleum Acts and Regulations and collection of mineral produced royalties. The activities cover five main areas; geology; minerals; petroleum; ground water; environments. See DMR structure and responsibilities in Fig. 6-3.

DEPARTMENT OF MINERAL RESOURCES

CENTRAL ADMINISTRATION

OFFICE OF THE SECRETARY
- general administration and correspondence.
- undertaking legal scrutiny and giving legal advice.
- undertaking public relation work of the Department.

PERSONNEL DIVISION
undertaking man power planning, work system, recruitment, personnel development, promotion and pension work.

FINANCE DIVISION
- finance, budgeting and accounting.
- equipment purchases.
- store keeping.

TECHNICAL AND PLANNING DIVISION
- undertaking analyses and case studies on mineral industry for planning and policy formulation.
- coordination and planning in international mineral and economic affairs.
- follow-up and assessment of the Department's work plans and projects.
- collection of data and preparation of mineral statistics.
- preparation of museum displays and museum development.
- library and documentation services.

MINING CONCESSION DIVISION
- granting and registration of prospecting licenses, permits concession and special concessions.
- regulagion and control of production and sale of minerals
- collection of fees, royalties and fines.

SURVEY DIVISION
- detailed mine mapping.
- boundary survey of areas under prospecting licenses and mining leases.
- mapping and map reproduction.

PREVENTION AND SUPPRESSION DIVISION
formulate, advise and enforce policy; measures and plans for provention and suppression of illegal mining, ore smuggling and minerals law violation.

MINING TECHNOLOGY DIVISION
- supervision, inspection and provision of recommendations on technical aspects of mining.
- research on and study for improvement of operational and mining efficiency and modernization of mining operations.
- research and investigation into beneficiation and promotion of mineral utilization.
- provision of assistance to mine operators in mining and in mineral dressing
- control of security and welfare state of mine workers, safety of operations organization and conduct of training courses in first aid and rescue operations.

METALLURGY DIVISION
- Supervision and inspection of metallurgical industry
- promotion and development of metallurgical industry
- research and development on extractive, physical and mechanical metallurgy
- compilation of statistics on domestic metal trade.
- economic analyses and feasibility study on metallurgical industry.

ENGINEERING DIVISION
- maintenance and repair of vehicles, machineries, equipments and instruments.
- carry out mineral exploratory drilling, soil tests, and blast holds drilling
- designs and inspection of Department's building constructions
- removing sand and mine waste deposited in water ways to prevent flood (only in certain areas).
- give assistance in mineral exploratory drilling and earth moving equipments to mine operators.

GEOLOGICAL SURVEY DIVISION
- geological survey and production of geological maps.
- survey and study of geological evidence.
- research on and study of fauna and flora fossila.

ECONOMIC GEOLOGY DIVISION
- provision and supervision of mineral exploration.
- study, exploration and research for mineral deposits.

MINERAL FUES DIVISION
- coordination on the awarding of concession.
- enforcement of the petroleum laws and regulations.
- supervision of petroleum exploration and production activities of concessionaires.
- collection and evaluation of petroleum data as well as providing information services.
- survey, detailed study and evaluation of coal deposits.

GROUND WATER DIVISION
- Conducting drilling operation for ground water.
- Development and maintenance of drilled wells.
- Conducting technical investigations of ground water.
- Developing rural piped ground water supply system.
- Conducting study and research on the aquifer system in the major groundwater basins.
- Operation of groundwater information centre to collect process and publish groundwater data.

GROUND WATER ACTIVITIES CONTROL DIVISION *(UNOFFICIAL)*
- Control of ground water activities (drilling for ground water, the use of ground water and the disposal of liquids through water wells) in the Ground water Area.
- Provision of principal and technical measures for ground water activities.
- Training for drillers from goverment sector and private sector.
- Charging fee for ground water use.
- Ground water data services (in Ground water control area)

ANALYSIS DIVISION
- conducting analysis, indentification and research on mineral, rock, soil, stream sediment, water, gemstone, metal, alloy and mineral fuel.

ENVIRONMENT DIVISION
- to facilitate coordination on mineral exploitation and conservation of natural resources and environment.

MINERAL RESOURCES DEVELOPMENT PROJECT
- conducting airborne geophysic surveys.
- follow-up ground surveys.
- formulating mineral resources development plan and policy

3 REGIONAL MINERAL RESOURCES OFFICES
in Songkla, Phuket and Chiang Mai
- supervision and provision of recommendations on technical aspects of mining and mineral dressing.
- survey and study of deposits of mineral.
- analysis on mineral resources.

INSPECTOR GENERAL

INTERNAL AUDITOR

SENIOR EXPERT

EXPERT

REGIONAL ADMINISTRATION
26 Provincial Mineral Resources Offices
- granting and registration of prospecting licenses, permits concession and special concessions.
- regulation and control of production and sale of mineral resources.
- collection of fees, royalties and fines.

- TAKUA PA
- PHUKET
- PHANGNGA
- SONGKHLA
- TRANG
- YALA
- NAKHON SI THAMMARAT
- SURAT THANI
- RANONG
- CHUMPHON
- KANCHANABURI
- RATCHABURI
- PRACHUAP KHIRI KHAN
- CHON BURI
- RAYONG
- TRAT
- CHANTHABURI
- CHIANG RAI
- CHIANG MAI
- LAMPHUN
- LAMPANG
- PHRAE
- MAE HONG SON
- TAK
- LOEI
- SARA BURI

Fig.6-3 DMR Current Structure and Responsibilities

3) DMR Environmental Policy

The policy of the DMR relating to environmental management is focused on implementation of efficient environmental regulations and implantation of environmental awareness among those concerned, as ultimate success in environmental protection and conservation cannot be achieved without cooperation from all sectors concerned. Preventive measures are then essential to reduce the risks of severe accidents.

In response to increasing environmental awareness in the country, DMR has become more involved with environmental aspects of mineral resources development. DMR has paid more attention to environmental protection from mineral resources development (evidenced from annual budget in last 5 years). In the last fiscal year (1995) DMR had set up 2.6% of total budget (about 41 million Baht) for supporting environmental protection projects. The environment budget has received increased support compared with 0.14% of total budget (1.4 million Baht) the budget for environmental protection in 1991 *(the Report to DMR, 1996).* DMR, has only two Divisions, **Mineral Fuels Division (MFD) and Environment Division (ED)** which is concerned with environmental protection related to Petroleum Exploration and Production activities in Thailand.

4) Mineral Fuels Division (MFD)

At present, the Mineral Fuels Division is the only ***key directly authority acting as a 'one-stop-shop'*** responsible for all upstream hydrocarbon activities in Thailand, including those related to the environment and safety. Most of the officers (80%) are Engineer and Geologist *(118 personnel in total).* See detail in MFD structure below.

4.a) Responsibilities and Functions

The main responsibilities of MFD include :

- enforcement of petroleum acts and regulations

- enforcement of safety and environmental standards
- appraisal of reserves and production capacity
- giving technical advice to the government
- collection of royalty, SRB
- petroleum information service

4.b) The Current Structure and manpower

MFD is now composed of 9 major sections and subsections, with currently **118 personnel** *(DMR (3), 1996)* as shown in Fig. 6-4.

Fig. 6-4 MFD Structure and Responsibilities *(Adapt form DMR(3),1996)*

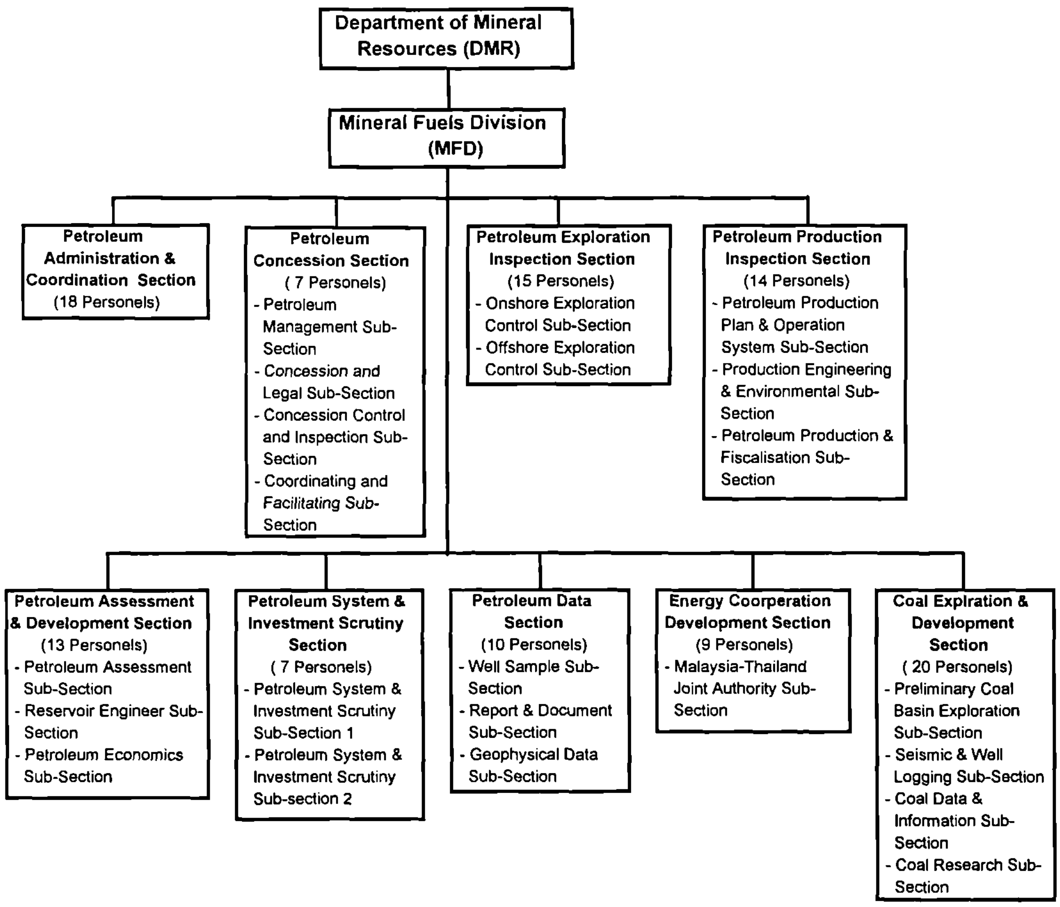


Fig. 6-4 MFD Structure and Responsibilities *(Source: Adapt from DMR(3), 1996)*

4.c) Type of Work

There are two main types of work in MFD, one is the office work (work scope as above) and the other is field work. For the field work, there must be at least one of MFD's competent officers staying at the site operation or platform as an inspector *(petroleum engineer or geologist)* for 24 hrs for the whole operation life *(the DMR inspector is changed on average every two-three weeks).*

The competent officers should have been appointed by the Minister to execute the Petroleum Act *(Petroleum Act, under Section 4).* Under Section 9 of the Petroleum Act, the competent officer have the power, related to environmental issues,

- to give a written instruction to the concessionaire to refrain from any performance which may cause damage to persons or to properties of other persons;

- to enter upon the places where petroleum operation is conducted and into the office of the concessionaire during office hours for the purpose of inspecting the petroleum operation and determining whether it is being carried out in compliance with the concession and with the provisions of the Act.

4.d) Environment Framework

There are two Sections in MFD which are concerned with environmental management for Petroleum E&P activities in Thailand. One is the Petroleum Exploration Supervisory Section where responsibilities include safety and environmental inspection and auditing for the exploration operation system. The other is the Petroleum Production Supervisory Section where responsibilities cover investigating

- drainage system of produced water from the petroleum production process;
- produced water quality before discharge;

- disposal system of waste petroleum, chemical and / or other substances (by-products) from petroleum production;
- Gas emission and Gas flaring system

(Source: Applied from DMR(3), 1996).

4.e) Regulations, Standards and Guidelines on Environment for E&P activities Project

In 1992, DMR (MFD) received technical assistance from the Asian Development Bank (ADB) to help the DMR draft environmental regulations and guidelines for Thailand upstream oil&gas industry. The study was conducted for nine months *(March-November 1993).* The Study Team comprised three expatriated and three local consultants. Technical and administrative support was provided by staff from DMR (MFD). The Study Team comprised three expatriates *(Dames & Moore, from Perth),* four local consultant members *(SEATEC, from Bangkok)* and one consultant member (Soil and Water Ltd., Regional Manager in South East Asia). Three technical and administrative support staff were provided from the DMR *(all were Engineers from Production Section of MFD).* The industry consultation phase of the investigation involved a review and inspection of the operations of four Concessionaires *(Thai Shell, Esso, UNOCAL, and North Central).*

The Study Team also conducted 15 days environmental training courses for DMR staff, particularly in relation to Environmental Impact Assessment (EIA) Procedures. (See the detail of the nine months ADB study results in Section 2). The nine months study resulted in proposed draft rules, which have been assigned to a task force that is responsible for setting measures for environmental management of the petroleum operations in line with the current situation of the country. It is seen to be still a long-term process. However, Taranajesda (1995) believed that 'it is anticipated that laws and regulations to deal specifically with environmental management of the upstream hydrocarbon industry will be issued soon'.

However, the ADB report has now been with DMR since December 1993, but as yet relatively little further action has been taken to implement its recommendations. This was the first comprehensive study to address the provisions for environmental management in Thailand's E&P Industry, and it took over twenty years to appear.

The ADB' s recommendations were strongly critisised by the E&P Thailand Industry (1993) in that "it is not particularly sensitive to the needs of Thailand and the regulatory framework does no reflect Thailand's needs. The purposed regulatory framework will place heavy financial burdens on both Industry and Government. It is, on the other hand, a very good comprehensive reference document" *(The Upstream Petroleum Industry Task Force,1993).*

The other strong criticism noted by Wuttishingchai, DMR Senior Environmental Scientist, (1996) was that "it must be recognized that DMR is unlikely to be allocated sufficient resources to be able to effectively undertake the scope of work that is called for. This is largely because the ADB recommendations are *heavily prescriptive*, and would result in a massive workload for DMR. DMR does not have the financial, organizational and skills resources to cope with such a workload. The detailed report requirements would also present *unreasonable challenges to the Industry*, resulting in cost and time hurdles". *See more detail in Section 2.*

4.f) MFD Environmental Investigation and Monitoring Project

During 1996 (about March-April), mercury pollution problems sourced from offshore gas production were becoming a "Touchy subject & Hot issues' in Thailand newspapers. At the time MFD carried out extensive detection, sampling and analysis of produced water (at separator sampling points, before discharge to the sea by sump caisson which is under sea water about 15 metres) and sea water (around production platforms). This project was executed in the two months period (May-June 1996) in cooperation with UNOCAL. The samples were collected two times per day, every day continuously for two months by DMR (MFD) inspector (Engineer) and UNOCAL (Manager, Environmental Programs, Health Environmental and Safety Department). Surprisingly no Environmental Scientist from the Environment Division of DMR joined this 'Confidential' project (and any MFD environmental projects), except for borrowing the sampling equipment from the Environment Division. However, the DMR Director-General directly commanded the Environment Division to report the mercury problem situation and recommendations to solve the problems for reporting to the Minister of Industry.

5) Environment Division (ED)

The DMR environmental unit was established in 1978, and extended to be the Environment Division in 1988, to enable the DMR to carry out its mandate effectively in the environmental field.

5.a) Main Function and Personnel

The main Division function comprises:

- reviewing and developing the regulations providing reasonable levels of safety and pollution control in the conduct of various mineral resources operation;
- set up environmental management plans and imposing control, prevention and correction & design measures on the environmental problems created by mineral resources development;
- monitoring and investigating environmental quality in the areas where the mineral resources development occurs;
- auditing environmental impacts and seeking appropriate means to ameliorate them;
- take action to solve environmental problems arising from minerals development to ensure enforcement of applicable regulations;
- advising and making recommendations regarding environmental management and producing guidelines for miners to follow;
- examining the EIAs of mineral resources development projects;
- co-operating with the related organizations and supporting their works as requested.

At present, the main roles of the Environment Division concern the mining area (Regular work), and only in short-time projects or spot-check about petroleum and ground water and only in the case of Minister orders. The lack of officers, especially experts in the Petroleum and Ground water field, and unclear DMR policies (especially, environmental management concerned with petroleum) are the main reasons for the limited scope of work of the Division. At present, the Division has only 33 people (18 environmental scientists staff) which is from the total number of employees in DMR currently not less than 4,600 persons.

5.b) Organizational Structure

Environment Division comprises three Sections and one sub-Section; Environment Section-1, Environment Section-2, Environment Section-3, and Administrative Sub-Section, which have the same following structures :

- technical and planning sub-section
- control and monitoring sub-section
- EIA report of investigation sub-section

5.c) Types of Work

There are two main types of work in ED, one is the office work (work scope as above) and the other is field work. For the field work, the Division has many viable projects, most of them are routine work, as inspection, monitoring and auditing field work and research work on environmental field concerning mining activities. All of the field work is only spot-check at the mining operation sites. There are no inspectors staying at the mining operation sites for 24 hrs of the whole operation life as in the case with the MFD (petroleum) field work inspectors.

5.d) Petroleum Environmental Project

The present situation is that there are no routine jobs which cover petroleum activities including in the duty of Environment Division except in some case which are commanded by the Director-General. There is some experience from the present low level of environmental inspection activity for E&P activities which has already been started by the Environment Division. In 1991, the Division started a one fiscal year project on 'Investigation, Evaluation and Policy Guideline Setting for Environmental Impacts Management From Petroleum Development of Thailand' and this was extend year by year until 1994.

However, due to unclear DMR policies concerning environmental management for petroleum activities and lack of the environmental scientist officers in the petroleum field (currently, only one senior officers responsibility for this project) in the Environment Division, this project can not be continued to act as a formal routine job in the Environmental Division.

6) Co-ordination between DMR and other Environmental Agencies

A joint committee (Sub-Committee on Environmental and Industrial Management Co-operation) between MOSTE and MOI, meeting monthly since 1993, oversees environmental matters that fall within MOI's scope. This includes the environmental management work undertaken by DMR for petroleum E&P operations. The committee is jointly chaired by the Permanent Secretaries of both ministries. It has appointed a task force (sub-sub-committee) of MOI (DMR) and MOSTE (OEPP, PCD) of officials to set environmental management guidelines for petroleum E&P, drawing on the recommendations of the ADB report. The task force, however, has not yet been drawn up, and therefore its work has not commenced [as at November 1995], (*Taranajesda, 1995, personal interview*).

6.8 Key Legislation Framework Concerning E&P Activities in Thailand

There are over 50 pieces of legislation which deal with environmental matters in Thailand, and they will take some time to be fully instituted. The primary national level environmental protection statutes include the following :

- The National Environmental Quality Act 1992,
- Air, Noise and Water Quality Standards, issued as Ministerial Notifications of the Ministry of Science, Technology and the Environment,
- Environmental Impact Assessment report requirement (in National Environmental Quality Act 1992),
- Hazardous Substance Act 1992,
- Public Health Act 1992,
- The Factory Act 1992.

At present, legislation is not being diligently enforced. There are no statutes dealing specifically in detail with the environmental management of petroleum E&P, but two main existing Acts are relevant :

1. The key statutory instrument for E&P is the *Petroleum Act 1971, as amended* and supplemented by Ministerial Regulations and Departmental Announcements.

2. Of potential importance in the future is the Enhancement and Conservation of National Environmental Quality Act 1992 (BE 2535), which is the primary source of Thai key environmental legislation.

6.8.1 Petroleum Act BE 2514 (1971)

The Petroleum Act is the principal law governing the operations of petroleum concessionaires. *(There is also a second Act of major importance, the Petroleum Income Tax Act 1971, but this is not applicable to this study).* The Act pertains to the conduct of petroleum operations undertaken anywhere within Thailand and its 200 mile territorial sea area. This Act distinguishes petroleum from other mineral resources for legislative purposes. It defines 'petroleum' as crude oil, natural gas and other petroleum by-products occurring naturally *(Section 4).*

The Act resulted from adoption of a concession and royalty system by the Thai government. The main concept of this system *(under Section 23)* is that petroleum belongs to the state, and any person can explore for or produce petroleum only after receiving a concession issued by the government, the Minister of Industry. When producing petroleum, under Section 82 the concessionaire must make a payment in terms of a royalty and tax according to regulation or rules issued by the government.

The Minister of industry in empowered to enforce the Act. In any decision related to a petroleum concession, such as awarding, expiration, extension and invalidating, the Minister exercises his power in consultation with the Petroleum Committee. The committee comprises the Permanent Secretary of Industry, as chairman, and fourteen members. They include 5 directors-general of DMR, Dept. of Land, Dept. of Fisheries, the Royal Forestry Dept. and the Revenue Dept. 3 delegates from the Ministry of Defense, Ministry of Finance and Ministry of industry and 6 cabinet nominees. The regulatory agency with overall responsibility for E&P and the Petroleum Act is the Department of Mineral Resources (DMR).

The Petroleum Act aims to regulate petroleum operations, including the exploration, production, storage, transport, sale or disposal of petroleum. The act is comprised of eight divisions: General, Petroleum committee; E&P Storage and transport; Sale and disposal; Concessionaires' benefits, rights, and duties; Royalties; and Punishment. Because of the relatively young age of the petroleum industry in Thailand, provisions in the Petroleum Act B.E. 2514 and amendments issued to-date, provide an umbrella for a wide range of environmental issues. Still, they are deficient in detailed regulation, especially regarding offshore operations. There are nine Sections (9, 12, 14, 74, 75, 80, 102*, 107* and 108* (* Offenses and Penalties) of the Act concerned with the protection of the environment, as follows :

- ***Section 9***, The Competent Officer (from DMR) who is appointed by the minister of industry, has the power to enter and inspect a petroleum operation and give written instructions to the concessionaire to refrain from any activities which may cause damage to persons and properties of other persons.

- ***Section 12***, in the case of public damage caused by the failure of the concessionaire to comply with the provisions of the Petroleum Act, and where the damage causes the public body to take measures in preventing or making good such damage, the concessionaire shall pay compensation for such damage and shall reimburse the expenses incurred through such measures in the amount of money determined by the Minister. This shall not exclude the right of the injured parties to claim compensation from the concessionaire due to such wrongful acts.

- ***Section 14,*** Provision for Ministerial Regulations [see below]

- ***Section 74***, in the conduct of petroleum operations in offshore areas, concessionaire shall not cause any unjustifiable interference with navigation, aviation, the conservation of the living resources of the sea, or scientific research and laying of submarine cables.

- ***Section 75***, the concessionaire must have the appropriate measures to prevent pollution through the discharge of oil, mud or any other substances, shall take immediate action to combat that pollution.

- ***Section 80***, in the conduct of petroleum operations, irrespective of whether the petroleum exploration rights under the concession have terminated or not, the concessionaire shall execute all operations in accordance with sound technical principles and good petroleum industry practice in respect to petroleum operations and conservation of petroleum resources.

Offenses and Penalties

- ***Section 102*** "Whoever fails to comply with paragraph (1), (2)or (3) of Section 14 shall be punished with a fine not exceeding fifty thousand Bath."

- ***Section 107*** " Any concessionaire who fails to comply with Section 74,....shall be punished with a fine not exceeding ten thousand Baht."

- ***Section 108*** " Any concessionaire who fails to comply with Section 75 shall be punished with a fine not exceeding one hundred thousand Baht."

1) Amendments to Petroleum Act

After the Act was promulgated in 1971, it was amended three times as follows :

- in 1973 as Petroleum Act (No.2) B.E. 2516, regarding operations in deep water offshore areas (defined as deeper than 200 metres);

- in 1979 as Petroleum Act (No.3) B.E. 2522, concerning modification of Exploration, production, and obligation periods and reporting process.

- in 1989 as Petroleum Act (No.4) B.E.2532, concerning modification of terms of concession and royalty in order to be appropriate for geological conditions and current situation in Thailand *(ADB,1993:18)*. Four major areas were revised such as the fiscal regime, land regime, role of the government, and provisional clause.

2) Regulations & Announcements pursuant to the Petroleum Act

The Petroleum Act, *Section 14,* has provisions for issuing Ministerial Regulations. These can relate directly or indirectly to environmental protection. The objective is to lay out guidelines and procedures for petroleum and environment undertaken by concessionaires. Currently, there are five such Ministerial Regulations, namely: Nos. 5, 6, 7, 11 and 12.

(i) ***Ministerial Regulation No 5; Article 3***, has provisions concerning a range of activities which could affect the environmental performance of an operation. These comprise:

- maintenance of structures, machinery, equipment and tools used in petroleum exploration, production and conservation in good working condition;
- seismic shot holes, casing and cementing, control of flow of petroleum and prevention of damage to the underground environment including oil or gas formation and *underground water*;
- drilling operations, especially blowout prevention;
- abandonment of exploration and production wells;
- disposal of wasted natural gas; and
- restoration of operations sites.

(ii) ***Ministerial Regulation Nos. 6 and 11,*** provide detailed specifications for safety zones and marks in the vicinity of installations and devices for both onshore and offshore operations.

(iii) ***Ministerial Regulation No. 7,*** is a regulation concerning care and protection of workers and safety of outsiders. It has detailed measures on working and living condition of workers, on safety in working and living environment, on installation and operation of machine and equipment, on electricity for petroleum operation and on explosive materials and operation.

(iv) ***Ministerial Regulation No. 12,*** includes a requirement for the Concessionaire to submit information relating to the position of the permanent production platform, standards used in

design of construction, measures used in preventing corrosion of the permanent production platform, the fire protection system, and the navigation aid system. Under clause 40 of this regulation, following completion of operations, the operating company shall, e.g.:

1. restore the land or offshore area to its former state, as far as is possible;
2. construct a wall or fence to cover pits, holes, channels and wells dug by the concessionaire;
3. fill up pits, holes, channels and wells not in use should be restored to their former state, unless with agreement of DMR or the landowner;
4. remove or destroy obstructions, nuisances or hazards to communication, fishing, or property, except with DMR permission.

3) DMR Announcements

The announcements are issued by virtue of Section 76 of the Petroleum Act and establish the measures for the concessionaires' report to the government. Since 1990 DMR has been revising both the Industry Ministerial Regulations and the DMR announcements.

6.8.2 Enhancement and Conservation of National Environmental Quality Act (NEQA) 1992

Basic provisions for the environmental management served as the basis of Thailand Environmental Law. The first Enhancement and Conservation of National Environment Quality Act (NEQA), 1975 (B.E.2518) was announced in 1975 and was amended by the Act No.2 in 1979 (B.E.2521) and the Act No.3 (1980) (B.E.2522). The Act requires for EIA report, provides environmental standards, monitoring and regulations for quality of air, noise, water and solid and hazardous water and, nuisance abatement. In 1992, under the new 1992 Act (Section 3) the three previous Acts were repealed.

The main key point of NEQA is the joint responsibility of the Prime Minister and the Minister of Science, Technology, and Environment (MOSTE). The Ministry is responsible for issuing Ministerial Regulations, setting out the requirements for provincial Natural Resource and Environment (NRE) planning, setting penalties for polluting, appointing pollution control officials, fixing fees, etc. The new 1992 Act introduced new strategies such as ;

- the Polluter Pays Principle,
- gave power to Non-Government Organizations (NGOs),
- created US $ 500 million environment fund for provincial government and business,
- increased fines (500,000 Bath, £1 = 43 Bath) and prison sentences (5 years) for offenders (company directors may be held personally liable).

The unique provision in the NEQA 1992 permits non-government organizations (NGOs) to be directly involved with environmental protection efforts (as a government assistance) without any objective to be involved in politics or to make profits from the engagement in such activities. The NGOs are duly registered with the MOSTE (under Section 7) for environmental protection and conservation of natural resources in accordance with the rules, procedures and conditions prescribed by Ministerial Regulation. Section 46 in Part 4 (EIA) of Chapter III (Environmental Protection); Section 57 in Part 2 (Emission or Effluent Standards) of Chapter IV (Pollution Control), Section 78 and Section 79 in Part 6 (Other Pollution and Hazardous Waste) of Chapter IV of the 1992 Act relate to oil & gas activities in Thailand as follows ;

Section 46 : Requirement of Environmental Impact Assessment (EIA) for upstream E&P activities

The Act stated that " ..... The Minister of Science, Technology and Environment shall have the power to specify, by notification published in the Government Gazette types and sizes of projects or activities of Government Agencies, State Enterprises or Private Sector which are likely to have environment impacts, are required to prepare reports on environmental assessment for submission to seek approval .... " .

The first Notification, issued in 1981, contained the ten project categories. There are currently three Notification of Ministry of Science, Technology and Environment (MOSTE) concerning report on Environmental Impacts, the Notification No.1 and 2 was noticed on 1992 and the Notification No.3 was noticed on January 1996. The upstream oil and gas activites was one of the five issues which was announced in the Notification No.3 (1996) ,which are required an environmental impacts report for of 'all capacities'. See detail in Table 6-3 and Table 6-4.

Table 6 - 3 Notice of MOSTE Concerning Prescription of Types and Capacity of Projects or Activities of Government Agencies, State Enterprises or Private Sector Requiring Creation of Reports on Environmental Impacts.

Notification No.1[a] *(given on 24th August 1992)*	**Notified No.2**[a] *(given on 9th September 1992)*	**Notification No.3**[b] *(given on 22nd January 1996)*
1. Dam or reservoir 2. Irrigation 3. Commercial Airport 4. *Hotel or resort facilities in areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks or hospital* * 5. Mass transit system 6. Mining 7. Industrial estate 8. Commercial port 9. Thermal power plant 10. Industries • Petrochemical Industry • Oil refinery • Chlor-alkaline Industry • Iron and or steel Industry • Cement Industry • Smelting Industry • Pulp Industry 11. All types of projects located in the areas where it has been approved by the Cabinet to be watershed area as class 1B	1. Coastal Reclamation 2. Building in areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks or hospital 3. *Residential Condominium*** 4. Land allocation for residential or commercial purpose 5. Hospital 6. Pesticide Industry or Industry producing Active Ingredient by chemical process 7. Chemical Fertilizes Industry using 8. chemical process in production 9. Highway or road passing through following areas • Wildlife Sanctuaries and Wildlife Non-Hunting Areas • National park • Watershed Area • Mangrove Forests Designated as the National Forest Reserve • Coastal Area within 50 m from the maximum sea level	1. Hotel and Resort 2. Building for common residence 3. Factory equipped for improving quality of wastes. 4. Industry engaged in operations concerning sugar as follows: • Producing raw sugar, white sugar and refined sugar • Producing glucose, dactrose, fructose or other products of similar nature 5. **Petroleum Development** • ***Exploration and/or Production of petroleum*** **(of all capacities)** • ***Petroleum and Fuel oil transportation system by pipeline*** **(of all capacities)**

Note : [a] Applied from the Report to DMR, 1996 [b] Applied from Policy and Environmental Office,1996
* Repealed and replaced by the provisions contained in serial No.1 of the Schedule attached to Notice No.3
** Repealed and replaced by the provisions contained in serial No.2 of the Schedule attached to Notice No.3

Table 6- 4 Schedule Attached to the Notice No. 3 of MOSTE Concerning Prescription of Standards, Procedures, *Rules and Regulations and Guideline for creation of Reports on* Environmental Impacts : In the case of Petroleum Development

Type of Project or Business	Procedures for Submission of Report
Explorations and/ or production	In case of project not required to get Cabinet approval, a Report shall be submitted at time of seeking concession and / or getting approval from the concerned authority, in accordance with petroleum law. In case of project requiring Cabinet approval, a Report shall be submitted at a time prior to getting approval from the Cabinet.
Petroleum Transportation system and transportation by pipeline of fuel	In case of project not required to get Cabinet approval, a Report shall be submitted at time of seeking licenses or at the time of seeking approval from the concerned authority In case of project required to have Cabinet approval, a Report shall be submitted at a time prior to getting Cabinet approval.

(Source: Applied from Policy and Planning Office,1996)

However, an EIA is not required in cases where there has already been an EIA concerning project or activity of any particular type or size, or site selection for such project or activity in any particular area and where such assessment can be used as a standard assessment applicable to the project or activity of the same type or size or to the site selection of such project or activity in the area of similar nature.

Section 57 : Emission of Effluent Standards

The Act states that "In case any state agency is empowered by the other law to prescribe emission or effluent standards in any matter, but that state agency fails to exercise its power, the Minister can take their power with the recommendation of the Pollution Control Committee and with the approval of the National Environment Board, publish notification in the Government Gazette prescribing the emission or effluent standards in question and such standards shall be deemed to have been set by the governing law on such matter".

Section 78: Pollution and Hazardous Waste Control for Petroleum Exploration and Drilling

The Act states that "the collection, transport and other arrangements for the treatment and disposal of garbage and other solid wastes; .... ; the prevention and control of pollution from the exploration and drilling for oil, natural gas and all kinds of hydrocarbon both on land and in the sea; and the prevention and control of pollution resulting from the discharge of oil and the dumping of wastes and other matters from sea-going vessels, tankers, and other type of vessel , shall be in accordance with the governing laws related thereto".

Section 79 : Pollution and Hazardous Waste Control for Petroleum Exploration and Drilling

The Act states that "In case of there is **no** specific law applicable thereto, the Minister shall, with the advice of the Pollution Control Committee, have the power to issue ministerial regulation specifying the types and categories of hazardous wastes generated from the production and usage of *chemicals or hazardous substances in the production process of industry, ..., and other* activities which shall be brought under control. For this purpose, rules, regulations, measures and method must also be prescribed for the control of collection, storage, safety measures, transportation, import into the Kingdom, export out of the Kingdom, and for proper and technically sound management, treatment and disposal of such hazardous wastes."

1) Standards on Pollution Control in Thailand.

The 1992 Act also provides a mechanism for establishing discharge, emission and ambient levels of pollutants. This mechanism is directly related to the proposed standards and guidelines listed in the 1989 Laws and Standards on Pollution Control in Thailand. This publication is a summary of relevant Thai environmental legislation. These 1989 Laws and Standards have three main Sections, which cover and review the National Environmental Quality Act, list requirements for EIA report preparation, and proposed Environmental standards and regulations for air quality, noise, water quality, solid waste and hazardous water and nuisance abatement. Several sections of the 1989 document may be relevant to upstream oil and gas industry.

2) Environmental Assessment Process in Thailand

Guidance on the format of the EIA report is provided by the Manual of NEB Guidelines for Preparation of EIA. There are multiple procedures for approval of the EIA report depending upon the nature of the project (such as government, *state enterprise, private sector or joint venture) and* funding sources of the project. The OEPP has established expert panels which provide technical assistance in the review of EIA reports. Representatives from various agencies and local technical experts comprise these panels. The Environmental Impact Assessment (EIA) reports which require approval prior to the granting of permission for implementation of projects must be prepared only by the persons or parties who have been approved as qualified by the NEB (Sec. 51 of the NEQA 1992).

Summary

DMR policy is to maximize the exploitation of resources to the utmost efficiency and benefit, and at the same time minimizing impacts on the environment. At present, there are no laws or regulations, standards, and guidelines that deal specifically in detail with the environmental management of Thailand's upstream oil & gas industry. There are only two main relevants Acts; the Petroleum Act 1971 and the Enhancement and Conservation of National Environmental Quality Act (NEQA)1992.

There are only nine sections (Sec. 9, 12, 14, 74, 75, 80, 102*, 107* and 108* (* offenses and Penalties) and five Regulations (Ministerial Regulation No. 5, 6, 7, 11, 12) under the Petroleum Act and only four Sections (Sec. 46, 57, 78, and 79) of the NEQA 1992 concerned with environment protection for oil & gas activities in Thailand. In practice the provisions of the Petroleum Act of 1971 are applicable to petroleum operations although the results are some what unsatisfactory. It is anticipated that laws and regulations to deal specifically with environmental management of the upstream hydrocarbon industry will be issued soon.

The Department of Mineral Resources (DMR) under the Ministry of Industry is the key institution concerned with this activity. The Department grants prospecting licenses for petroleum, and is responsible for supervising mineral resources exploration and production activities in accordance with the terms of the concessions. The functions concerned with environmental protection involve the enforcement of Petroleum Acts and Regulations, safety and environmental standards.

However, the Office of Environmental Policy and planning (OEPP) is an other main important authority which can affect oil and gas activities. Under the NEQA 1992, Notice of Minister of Science, Technology, and Environment (MOSTE) No. 3 the upstream oil and gas activities require an environmental impact assessment (EIA) for of all capacities. This Notification was given on 22nd January 1996. Also, there are the other authorities such as the Pollution Control Department (PCD), the Environmental Quality Promotion Department (EOPD), and the other Ministries may be relevant to this activity.

Section 7

REVIEW OF THE ENVIRONMENTAL LEGISLATIVE AND INSTITUTIONAL FRAMEWORK EFFECT ON THE OIL & GAS INDUSTRY IN THE UK

7.1 Introduction

This section focuses on environmental management (Legislative and Institutional framework) related to upstream E&P industry in UK by reviewing in detail: the international and regional conventions; treaties; guidelines. Recommended practices, which affect the UK regulations, are also reviewed.

7.2 International and Regional Conventions, Laws and Agreements which affect UK Offshore Oil & Gas Industry

7.2.1 International Law

The development of international treaty law for offshore oil and gas activities can be traced to the UN Geneva Conference of 1958 (UNCLOS I). This conferences adopted four Conventions on the law of the sea and one of this conference on the Continental Shelf 1958 provided coastal states with sovereign rights to explore and exploit the mineral resources of their continental shelves, thus providing for the development of the offshore oil industry. International conventions and agreements can be divided into two types: One aims to prevent damage to the environment, and the other regulates liability for damage after it has occurred.

7.2.1.1 Global Conventions

a) Geneva Convention 1958

The first United Nations Conference on the Law of the Sea in 1958 adopted four conventions on the Territorial Sea, the High Seas, the Continental Shelf and finally on Fishing and Conservation of the Living Resources of the Sea. The Geneva Convention of the Continental Shelf established the concept of a Continental Shelf and States' rights to explore for and exploit any resources found and associated with such rights were obligations regarding the protection of the marine environment. The Geneva Convention contains provisions relating to pollution from offshore installations as ;

- Article 5(1) provides that the exploration of the continental Shelf must not result in any unjustifiable interference with navigation, fishing or the conservation of the living resources of the sea;
- Article 5(2) and (3) allow a state to establish safety zones of 500 m around offshore installations;
- Article 5(5) requires the complete removal of any installations abandoned or disused;
- Article 5(7) obliges states to take measures in these safety zones for protection of the living resources of the sea.

The High Sea Convention requires states to draw up regulations to prevent pollution of the seas by discharge of oil from pipelines or resulting from oil exploration and exploitation.

b) United Nations Convention on the Law of the Sea 1982 (UNCLOS)

UNCLOS is the most important international convention governing the protection of the marine environment (*Kimber,1994*). It was drawn up in 1982 by the third United Nations Conference on the Law of the Sea to bring together in one convention the international law relating to the sea, and establish a comprehensive legal regime for the seas and the oceans. UNCLOS is also important in that it increases the jurisdiction of a coastal state over the protection of the environment by allowing it to increase control over a 12 nautical mile territorial sea and a 200 nautical mile Exclusive Economic Zone. The other important aspect is that UNCLOS merely sets out the general obligations of States and calls on them to enact laws and measures to protect the environment from damage caused inter alia by **oil and gas activities** *(Kimber,1994)*. However, it does not lay down specific and certain rules as to when damage is caused and how liability is to be determined. In Part XII of UNCLOS is the legal regime for the protection and preservation of the marine environment and this is set out as follows;

- Article 192 expressly mentions that States have a duty to protect and preser the marine environment .
- Article 194 which relates to measures to prevent, reduce and control pollution in the marine environment as follows :

"States shall take all necessary measures consistent with this Convention to prevent, reduce and control pollution of the marine environment from any source using for this purpose ***the best practicable*** means at their disposal and in accordance with their capabilities, individually or jointly as appropriate, and they shall endeavour to harmonise their policies in this connection. States shall take all necessary measures to ensure that activities under their jurisdiction or control are so conducted that they do not cause damage by pollution to other states and their environment.

The measures taken pursuant to this Part (Article 194) shall deal with all sources of pollution of the marine environment. These measures shall include, inter alias , those designed to minimise to the fullest possible extent, pollution from installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil, in particular for prevention of accidents and dealing with emergencies, ensuring the safety of operations at sea, and regulation of the design, construction, equipment, operation and manning of such installations or devices."

- Article 208 requires States to adopt laws and regulation to prevent, reduce and control pollution of the marine environment from seabed activities and installations subject to their jurisdiction.
- Article 214 requires States to take measures to enforce their laws and regulations related to the protection of the marine environment.
- Article 218 allows port States to exercise jurisdiction in certain circumstances over foreign vessels entering their ports who have discharged polluting materials into high sea or the territorial seas of another State.

c) OILPOL 1954 and MARPOL 73/78 : Convention for the Prevention of pollution from Ships

The International Convention for the Prevention of Pollution of the Sea (OILPOL) 1954 was the first international convention to establish provisions for the prevention of marine pollution. This Convention is now largely superseded by the entry into force of MARPOL 73/78. However, OILPOL 1954 remains in force only for those states party to the Convention but not party to MARPOL.

The MARPOL 73/78, one of the most important international Conventions on marine pollution, was agreed in October 1973 and subsequently amended by a Protocol in 1978, prior to entering into force for the UK in October 1983. The foundation of MARPOL 73/78 purpose is to be the provision of adequate facilities for receiving wastes from ships. MARPOL's stated purpose is to completely eliminate the intentional discharge of oil from ships. This Convention contains five Annexes dealing with pollution by oil, noxious liquid substances carried in bulk, harmful substances carried in packages, sewage and garbage. The Articles of the Convention deal with the application, entry into force and amendments of the Annexes and introduce a 'tacit acceptance ' system.

Only the provisions of Annex I (oil pollution) are pertinent to these provisions to offshore installations. Several amendments to Annex I have been adopted since the Convention entered into force, the most notable of which, made in March 1992 and entering into force in July 1993, considerably reduced the permissible maximum oil content of effluents discharged from ships. The main requirement of the Convention is that the discharge or dumping of all of these pollutants into the sea is forbidden. New tankers are not allowed to discharge more than 1/30,000th of the volume of cargo carried during their previous voyage. When discharging oil (any petroleum form), proper oil discharge and oil/water separation or oil filtering equipment are to be employed.

MARPOL 73/78 requires that fixed platform and mobile offshore drilling unit discharges from "machinery spaces" are, in fact, governed by the Convention. The separation of oil and water is required to provide for discharges not to exceed those specified for non-oil tankers of 400 tons gross tonnage and above. Under Regulation 21c, the oil content of discharges within 12 nautical miles of the coast and within designated Special Areas should not exceed 15 ppm, or, outside these areas, 100 ppm, unless more stringent national regulations apply. Other potential pollution sources were also covered, including bulk noxious liquid substances, sewage, garbage and harmful packaged products.

d) OPRC 1990 : Oil Pollution Preparedness, Response and Co-Operation 1990

The OPRC is designed to promote co-operation and assistance between States in the event of a major oil pollution incident. The Convention requires States to ensure that offshore installation operators have approved emergency plans which are developed in co-ordination with emergency plans of the coastal States. At present the IMO is considering the development of more detailed guidelines to assist states with the preparation of such plans.

e) ESPOO 1991: Environmental Impact in a Transboundary Context

This proposed Convention is a recent development at the European level, it requires environmental assessments to be carried out for projects which will take place in one State but will impact on other

States. The requirement will include large diameter oil and gas pipelines and offshore petroleum production. However, this Convention is not yet in force.

7.2.1.2 Regional Conventions

The UN Conference on Human Environment (UNCHE) 1972 established and action plan and instituted the United Nations Environmental Programme (UNEP), part of which has resulted in the development of framework conventions for now 11 regional sea areas. The North Sea legal regime derives principally from the Oslo Convention on the Prevention of Marine Pollution by dumping from Ships and Aircraft (1972), the Paris Convention on the Prevention of Marine Pollution from Land-based Sources (1974) and the Bonn Agreement for Co-operation in Dealing with Pollution of the North Sea by Oil and Other Harmful Substances (1983, but for oil dating from 1969). The latter applies only to the North Sea and English Channel but similar arrangements can be found in the Lisbon Co-operation Agreement for the Protection the Coasts and Waters of the North East Atlantic Against Pollution (1990) which apply to other parts of the UKCS.

Nevertheless, the Oslo and Paris Conventions, apply to the North-East Atlantic area as a whole excluding the Baltic and Mediterranean Sea areas. Both the Oslo and Paris Conventions established Commissions, now combined in a joint Oslo and Paris Commission (OSPARCOM), which additionally services the meetings held under the Bonn Agreement. A new Convention on the Protection of the Marine Environment of the North East Atlantic signed in Paris 1992 will replace the earlier Oslo (1972) and Paris (1974) Conventions with its entry into effect, and while this provides a greater degree of unification it will also introduce some significant changes to the historical approach of the prevention of pollution of the sea towards a regime concerned more generally in the protection of the marine environment. This new Convention is based on the principles of Best Available Techniques, Best Environmental Practice and where, appropriate, clean technologies.

a) European Community (EC) Law

a.1) The North Sea Conference : the meeting point

In 1984, the main achievement of the first North Sea Conference was to have met, and agreed some common ground. The second conference, in November 1987, was the scene of some remarkable political manoeuvring and two remarkable results. The eight nations agreed to adopt the 'precautionary principle ' as their guiding light in protecting the North Sea and, as a result, to reduce discharges of what they believed to be especially toxic substances, and nutrients, to 50% of their levels by 1995. The second conference also agreed to end industrial waste dumping by the end of 1989, to stop ocean incineration by the end of 1994, to reduce the disposal of rubbish, oil and chemicals from ships at sea, to reduce the amount of oil being discharged in oil-based muds from drilling platforms, and to set up a Scientific Task Force to harmonise research into pollution of the North Sea.

At the third conference, in March 1990, the North Sea states added atmospheric pollution to those subject to a 50% reduction by 1995, and decided to reduce pollution from some substances, including dioxins, by at least 70% by 1995. Ocean incineration was now to end by 1992. Seven states declared that the North Sea and its seabed were not suitable dump sites for radioactive waste- while the UK, the only country actually contemplating such a move, refused to accept this agreement. The UK agreed to stop dumping industrial waste by 1993, having already failed to meet the 1989 deadline set at the second conference. Also, the UK promised to stop sewage sludge dumping - by the end of 1998.

However, the UK government had put itself out on a limb. It had vowed to continue sewage sludge dumping until 1998, and had renewed permits to continue dumping toxic industrial waste, despite signing the second North Sea conference's commitment (1987) to end in 1989, and it proposed to bury radioactive waste under the seabed off Dounreay in Scotland. The effect of all this was aptly summed up by the Dutch minister for the environment, who had also chaired the conference. There had, she said, been two major problems at the meeting: the failure to reduce nutrients - and the United Kingdom, who had consistently blocked progress across the board (*MacGarvin, 1992*).

To tackle local problems more efficiently, the governments around the Northeast Atlantic created two sister commissions: the Oslo Commission *(OSCOM),* in 1972, concerned with dumping, and the Paris Commission *(PARCOM),* in 1974, which regulates pollution from land-based sources. These negotiated legally binding agreements on the amounts of various chemicals that could be dumped or discharged (*MacGarvin,1992*). The international authorities that regulate activities in the North Sea tend to concentrate on specific issues on the problems that beset and which the North Sea stem mainly from six areas of human activity : the destruction of wildlife and natural habitats, shipping, pollution (from both industry and agriculture), **the extraction of oil and gas**, fishing, and military activities.

a.2) The London Dumping Convention 1972

The Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter, 1972 (the London Dumping Convention). The convention prohibits the dumping of certain waste, and requires that persons obtain permits prior to dumping certain wastes. Each state party is obliged to ensure that the Convention is applied by vessels registered under its territory or flying its flag, as well as those found under its jurisdiction, and those whose load (matter) is to be dumped. There is concurrent jurisdiction between the coastal state, the flag state and loading state.

a.3) The Paris Convention 1974

The Paris Convention on the Prevention of Marine Pollution from Land-based Sources 1974 entered into force in May 1987 and extends to the north-east Atlantic and Arctic Oceans. The Convention was specifically designed to control the discharge of pollutants emanating from land - based sources. However, its provisions apply equally to pollution from pipelines and man-made structures under the jurisdiction of a Contracting Party. Annex A of the Convention allocates pollutants to one of two lists ('Black list' and 'Grey list') depending on their toxicity, persistence and tendency to bio-accumulate.

a.4) Paris Commission 1976 (PARCOM)

In 1976 a working group on Oil Pollution (GOP) was established under the Interim Paris Commission with regard to the reduction of discharges of oil from offshore installations. In the later year the PARCOM (the Convention's governing body) adopted a joint proposal from France and the UK that all new platforms be equipped with the best practicable means for separating oil from discharged water, and that means consist of corrugated plate interceptors, gas flotation units, or other equipment capable of reducing the average ***oil content of a discharge*** to within the range of 30-50 ppm. PARCOM therefore adopted a provisional ***target standard of 40 ppm.*** Other decisions have been made on the use of oil based muds and on the banning of diesel muds. The mean ***oil content of discharged cutting to 100 g/kg of cuttings.***

a.5) PARCOM 1992 : The Protection of the Marine Environment of the North-East Atlantic

The new Convention contains some provisions relating to pollution from offshore sources as follows;

- Article 5 requires the parties to commit themselves to taking all possible steps to prevent and eliminate pollution from offshore sources in accordance with the provisions of the Convention;

- Article 3(1) prohibits the dumping of wastes and other matter from offshore installations;

- Article 4 provides that use of certain substances on or the discharge or emission from offshore sources shall be strictly to authorisation or regulation by competent authorities. ***However, apart from this the Convention does not contain specific rules in relation to discharges from offshore installations.***

This new Convention will replace two older Conventions, the 1972 Convention for the prevention of Marine Pollution by Dumping from Ships and Aircraft (Oslo Convention) and the 1974 Convention for the Prevention of Marine Pollution from Land Based Sources (Paris Convention) when it has entered into force.

a.6) Environmental Impact Assessment Directive 85/337/EEC

The Directive is designed for the assessment of the effects of public and private projects on the environment, it was adopted in June 1985. Member States of the EU are required by this Directive to implement legislation in their own countries which will require detailed assessments of the effects of projects on human beings, environment, and the interaction between them. This assessment must then be made available to environmental bodies within a state for their consideration and comment, including public concern for an opinion before a project is started.

The projects which have effects on the environment are listed in Annexes. At present there are only two Annexes. Annex I, an EIA must be undertaken before development consent is given. Annex II, an EIA requirement is dependent on member States consideration. ***Petroleum exploration and development falls under the Annex II. In effect this means that an EIA will not be required for offshore oil & gas activities in the ordinary course of events, but only where a State thinks that a particular development is especially sensitive or has characteristics which would make it necessary*** *(Kimber, 1994)*

This EU Directive for environmental Assessment has never been legally implemented for the offshore oil and gas industry in the UK. The UK, under the guidance of its regulator the DTI, now plan to fully implement the EU Directive to the offshore industry. The culmination of this plan is that offshore operators may be required to produce an 'Environmental Case' providing a cradle to grave account of the environmental effects from their oil & gas operations *(Jones et al,1996).* The content of the Environmental Case will be adopted in the concepts as follow:

- ***Evolutionary***, cradle to grave approach covering all phases of a development from design through to abandonment.

- ***Goal setting,*** encouraging mutual agreement between regulator and operator for following strategies aimed at improving environmental performance to agreed level.

- ***Cost benefit,*** in order to demonstrate that environmental improvements are not placing unacceptable financial burden on the offshore oil and gas industry. It is possible that the onshore concepts of BPEO and BATNEEC will be developed offshore.

- **Holistic,** treatment of safety and environmental issues. Offshore Safety Risks can be represent a risk to the environment. But Environmental Case is likely to additionally consider the effects of routine emissions not considered in the Safety Case.

However, the government is currently on the regulations needs to put into law EC Directive 85/337 on EIAs as it applies to oil & gas projects. See (below) the latese European Directive (EC Directive 97/11) about EIA requirement for oil & gas activities.

a.7) The EU Directive on Integrated Pollution Prevention and Control 96/61/EC (IPPC Directive)

The IPPC directive was formally adopted on 24 September 1996. By October 1997, the Directive requires Member States to ensure that none of the installations listed in Annex I of the Directive operate without a permit issued in accordance with the Directive, the deadline is extended to 2005 for existing installations *(ERT,1997).*

Such permits are to be issued subject to conditions setting, inter alias, emission limit values, for all emissions to the environmental based on Best Available Techniques (BAT). Eventhough, the term 'Not Entailing Excessive Cost' is omitted in the new Directive (the term is used in the Environmental Protection Act 1990) but the available techniques are defined as 'those developed on a scale which allows implementation in the relevant industry sector, under economically and technically viable conditions, taking into consideration the costs and advantages...'.

EU proposals in the pipeline for 1997 include a Proposal for a Directive on environmental control not covered by this new Directive. Whether or not this will extend to offshore installations remains to be seen.

a.8) EC Directive 97/11 : A Mandatory EIA requirement for any Oil & Gas Activity

EC Directive requires a mandatory environmental impact assessment (EIA) for any oil & gas activity expected to produced at least 500 tonnes of oil or 500,000 cubic metres of gas a day, or the installation of offshore pipelines over 800 mm diameter and 40 km long. This European Directive 97/11 on EIAs was agreed in April 1997 and is required to be implemented by the end of March 1999 *(DTI(2), 1997).*

b) Future Trends and Proposed Legislation affecting UK environmental Law

EIA requirement : On 10 September 1997, Minister John Battle (the Ministry of Science, Energy and Industry) announced that 'I see no reason to wait until 1999 to bring into effect the latest European Directive on EIAs and I expect all relevant projects needing our approval under the new regulations to carry out the full assessment'. He has decided that criteria set out in the latest European Directive which require compulsory EIAs for offshore developments over specified thresholds will be applied this year rather than waiting until March 1999 *(DTI(2), 1997).*

He also mentioned that companies applying for consent for projects reaching these thresholds must prepare EIAs and give the public access to them before Government approval can be given. Under this regulations, the Secretary of State will decide on a case by case basis which projects require a assessment. He published for consultation draft regulations on 17 July 1997 that would implement into law EU Directive 85/377. Comments are required by 1 October 1997 *(DTI(2), 1997).*

Emission Standards : Traditional international environmental legislation has concentrated on the development and reduction of specific emission standards arbitrated by Best Available Technology. Current debate in international fora suggests that this broadly prescriptive approach will continue to provide an important element of future environmental legislation *(ERT,1997).* Where the relevant international provisions have been implemented in the UK, this approach has made itself obvious in the national UK environmental legislation regime. The European Union's concession to the UK stance has seen a dual approach emerge in European Union Law enabling both emission standards and quality objectives to be used, this alternative approach can also be seen in UK environment law.

In effect UK environmental law can be characterised by the different approaches which are 'prescriptive' and 'goal setting' approaches *(ERT,1997).* These two alternative philosophies are likely to continue to provide the foundation for policy. There are, however, a number of important emerging concepts in this debate which will shape the course that future environment law takes and will thus undoubtedly influence future requirements for of the UK oil and industry.

7.3 THE UNITED KINGDOM

7.3.1 UK Environmental Policy and Legislation

The UK government believes that in environmental protection, prevention is better than cure. All environmental protection policy is aimed at the prevention of damage. Within this preventative approach the government will take precautionary action when the risks justify it, even if scientific knowledge is not complete. Currently, the concept of sustainable development has become an important element of UK government policy. The policy and agenda in pollution control are reviewed by the strategy document, the Sustainable Development: the UK Strategy, for achieving a sustainable economy.

An interesting feature of the sustainable development ethos has been the integration of environmental of environmental considerations in other sectors, most notably the energy sector. In November 1996, Statutory Ministerial Guidance on Sustainable Development was published which is required by the Environmental Act 1995 *(ERT,1997).* It is also supports the principle of integrating environmental considerations into economic decision - making. The Government is considering how its own policies and actions can be further guided by these principles, and it is taking a leading part with other countries in bringing about their implementation world-wide.

The principle of Integrated Pollution Control, the 'Polluter Pays' principle, the duty of care of producers of waste, greater public access to environmental information, stricter Enforcement and Environmental Strategy are important features. The environmental strategy which is based on a 'pro-active' rather than a 're-active' action would clearly be advisable to ensure compliance with the various new environmental standards and controls in UK, especially those such as BATNEEC and the duty of care of producers of waste.

The Integrated Pollution Control (IPC) concept is also having an important influence on the future development of the UK environmental law. The concept has already been forced into the

Environmental Protection Act 1990, Part I. IPC can be seen to play a part in the development of the Best Practicable Environmental Options (BPEO) statement. At presently, the BPOE methodology is used in the UK for licensing the disposal of waste at sea under the provisions of the Food and Environmental Protection Act 1985, Part II, before issuing a license the regulatory authorities must be satisfied that all alternative options have been considered.

The environmental policy of the UK is now being profoundly influenced by developments within the Commission for the European Community (EC) and a number of European Community Directives concerning water now exist. The most important one is the Directive on Pollution caused by certain dangerous substances discharged into the aquatic environment of the community (76/464/EEC published 4 May, 1976) (*Grathorne, 1990*). This is sometimes known as the Dangerous Substances Directive. It applies to all water bodies to which discharges of the substances covered by the Directive are made, i.e., fresh, estuary, marine, and ground waters. This Directive has been the origin of the debate involving the relative merits of the Environmental Quality Objective (EQO), Environmental Quality Standards (EQS) and the uniform emission standards approaches to pollution control. Both are recognised as ways of controlling substances of concern and it worth briefly summarising the elements of each.

In the UK, as elsewhere in Europe, all political parties are becoming **'Greener'**, partly in response to public concern about specific topics such as deterioration of the ozone layer, acid rain, and the greenhouse effect, partly in response to an anti-science view which opposes **'synthetics'** and **mistrusts expert opinion**, and partly due to an anti-industry view. EEC Directives on environmental matters, many arising from 'Green pressures' in Germany, Holland, and Denmark, will increasingly dictate the regulatory scene in the UK (*Linton,1990*).

7.3.2 Environmental Policy related to E&P activities

The Joint Links' Oil & Gas Consortium has produced a policy for oil & gas activity on the UK continental shelf and internal waters. This calls for certain areas, because of their sensitivity, to be designated as ***'sacrosanct or moratoria areas'*** that should not be considered for oil & gas activities *(Marine Conservation Society, 1996).* The 17th oil & gas licensing Rounds to be suspended until environmental conditions adequate to meet the UK's international commitments are in place. The joint Links' Oil & Gas Consortium comprises Wildlife and Countryside Link, Scottish Wildlife and Countryside Link, Northern Ireland Environmental Link and Wales Wildlife and Countryside Link.

7.3.3 Environmental Management System (EMS)

The Organisation for Economic Co-operation and Development (OECD) was responsible for establishing Agenda 21- a global plan of action for the environment. OECD directs its efforts at promoting sustainable development, integrating economic and environmental decision-making and it calls member countries to recognise opportunities for advances to be made at the domestic / local level. To this end it regularly publishes an environmental performance review for the UK, through which it aims to aid environmental improvement. In the latest review, it is reported that over the last 15 years, UK governments have pursued environmental objectives "within the framework of an overall economic policy, stressing fundamental reliance on market principles".

An interesting point raised by OECD is that although "the UK government has stated that it is committed to using economic instruments for environmental protection ... such use is currently largely limited to energy taxation." Cramer and Schot (1993) reported that the UK government approach is largely traditional in its nature: focusing on regulatory measures directed towards limiting contaminant release by industry. The UK Government is fostering this approach by encouraging local authorities to establish Local Agenda 21 programmes. It is envisaged that these would incorporate "Regional Environmental Management Systems" (REMS) which would allow the emergence of local initiatives, central to which is the opportunity for increased co-operation between industry, businesses, public sector institutions and other agencies. However the problems associated with such leadership are extensive and can not be undermined in light of existing pressures exerted on firms. Williams, Medhurst and Drew (1993) identified that these may include:

- increasingly stringent environmental legislation and enforcement
- increasing costs associated with pollution control, waste disposal and effluent disposal

- increasing commercial pressure from the supply, consumption and disposal of both final and intermediate products
- increasing awareness on the part of investors of companies' environmental performance in view of the cost of implication associated with liability and the polluter pays principle
- increasing expectations on the part of the local community and the workforce concerning the environmental performance of firms.

7.3.4 UK Environmental Management Standard

The mostly uptodate of the British Standards(BS) are ' BS EN ISO 14001: 1996' and ' BS EN ISO 14004 : 1996', which having been prepared by Technical Committee ES/1 under the direction of the Management Systems Sector Board, and were published under the authority of the Standards Board. It is identical with ISO 14001 : 1996 and ISO 14004 : 1996 published by the International Organisation for Standardisation (ISO). The Standard came into effect on 15 September 1996.

BS 'ISO 14001 : 1996' - Environmental Management Systems : Specification with Guidance for Use

This International Standard specifies requirements for an environmental management system, to enable an organisation to formulate a policy and objectives taking into account legislative requirements and information about significant environmental impacts.

General requirements: ISO 14001 contains requirements that may be objectively audited for certification / registration purposes or for self- declaration purposes. The specification is based on the concept that the organisation will periodically review and evaluate its environmental management system in order to identify opportunities for improvement and their implementation. Some improvement in environmental performance can be expected due to the adoption of a systematic approach. Integration of environmental matters with the overall management system can contribute to the effective implementation of the environmental management system, as well as to efficiency and to clarify of roles.

This International Standard contains management requirements, based on the dynamic cyclical process of PLAN, IMPLEMENT, CHECK, and REVIEW. The system should enable an organisation to

- establish an environmental policy appropriate to itself; The policy should reflect the commitment of top management to compliance with applicable laws and continual improvement.

- identify the environmental aspects arising from the organisation's past, existing or planned activities, products or services, to determine the environmental impacts of significance;

The process to identify the significant environmental aspects associated with the activities at operating units should, where relevant, consider ; a) emissions to air; b) releases to water; c) waste management; d) contamination of land; e) use of raw materials and natural resources; f) other local environmental and community issues. This process should consider normal operating conditions, shut-down and start-up conditions, as well as the realistic potential significant impacts associated with reasonably foreseeable or emergency situations.

- identify the relevant legislative and regulatory requirements;
- identify priorities and set appropriate environmental objectives and targets;
- establish a structure and programmes to implement the policy and achieve objectives and targets;
- facilitate planning, control, monitoring, corrective action, auditing and review activities to ensure both that the policy is complied with and that the environmental management system remains appropriate;

The audit programme and procedures should cover a) the activities and areas to be considered in audits; b) the frequency of audits; c) the responsibilities associated with managing and conducting of audits; d) the communication of audit results; e) auditor competence; f) how audits will be conducted.

- be capable of adapting to changing circumstance.

BS EN ISO 14004 : 1996 - Environmental Management Systems : General Guidelines on Principles, Systems and Supporting Techniques

The general purpose of this International Standard is to provide assistance to organisations implementing or improving an EMS. It is consistent with the concept of sustainable development and is compatible with diverse cultural, social and organisational frameworks. This Standard considers the elements of an OEMs and provides practical advice on implementing such as a system. However, this guidelines are intended for use as a voluntary, internal management tool and are not intended to be used as EMS certification / registration criteria *(BSI,1996).*

The principles of EMS are **Commitment and Policy, Planning, Implementation, Measurement and Evaluation, Review and Improvement**. An environmental policy should be consider a) the organisation's mission, vision, or values and beliefs; b) requirements of and communication with interested parties; c) continual improvement; d) prevention of Pollution; e) guiding principles; f) co-ordination with other organisational policies; g) specific local or regional conditions; h) compliance with relevant environmental regulations, law and other criteria to which the organisation subscribes. Key principles for managers implementing or enhancing an environmental management system include as follows ;

- recognise that environmental management is among the highest corporate priorities.

- establish and maintain communication with internal and external interested parties;
- determine the legislative requirements and environmental aspects associated with the organisation' s activities, products or services;
- develop management and employee commitment to the protection of the environment, with clear assignment of accountability and responsibility;
- encourage environmental planning throughout the product or process life cycle;

The environmental management system elements relating to planning include a) identification of environmental aspects and evaluation of associated environmental impacts; b) legal requirements; c) internal performance criteria; d) environmental objectives and targets; e) environmental plans and management programme.

The identification of environmental aspects and the evaluation of associated environmental impacts is a process that can be dealt with in four steps as Step 1 - Select an activity, a product or service; Step 2 - Identify environmental aspects of the activity, product or service; Step 3 - Identify environmental impacts; Step 4 - Evaluate significance of impacts. Evaluation can be facilitated by considering environmental concerns and business concerns. Environmental concerns are about the scale of the impact; the severity of the impact; probability of occurrence; duration of impact. Business concerns are about potential regulatory and legal exposure; difficulty of changing the impact; effect of change on other activities and processes; concerns of interested parties; effect on the public image of the organisation.

- establish a process for achieving targeted performance levels;

  The objectives can include commitments to

  1. reduce waste and the depletion of resources;
  2. reduce or eliminate the release of pollutants into the environment;
  3. design products to minimise their environmental impact in production, use and disposal;
  4. control the environmental impact of source of raw material;

5. minimise any significant adverse environmental impact of new developments;
6. promote environmental awareness among employees and the community.

Progress towards an objective can generally be measured using environmental performance indicators such as ;

- quantity of raw material or energy used;
- quantity of emissions such as CO_2;
- waste produced per quality of finished product;
- efficiency of material and energy use;
- amount of material and energy use;
- number of environmental incidents
- number of environmental accidents
- percentage waste recycled;
- percentage recycled material used in packing;
- number of vehicle kilometres per unit of production;
- specific pollutant quantities;
- investment in environmental protection;
- number of prosecutions;
- land area set aside for wildlife habitat.

- provide appropriate and sufficient resources, including training, to achieve targeted performance levels on an ongoing basis;
- evaluate environmental performance against the organisation's environmental policy, objectives and targets and seek improvement where appropriate;
- establish a management process to audit and review the EMS and to identify opportunities for improvement of the system and resulting environmental performance.

The review of the environmental management system should include as follows;

- a review of environmental objectives, targets and environmental performance;
- finding of the EMS audits;
- an evaluation of its effectiveness;
- an evaluation of the suitability of the environmental policy and the need for changes in the light of
    a) changing legislation,
    b) changing expectations and requirements of interested parties;
    c) changes in the products or activities of the organisation,
    d) advance in science and technology,
    e) lessons learned from environmental incidents,
    f) market preferences,
    g) reporting and communication.

- encourage contractors and suppliers to establish an EMS.

8.3.5 UK Environmental Pollution Control Systems

Air Pollution

Some of the earliest environmental legislation enacted was directed towards the control of air pollution. As early as 1285 Edward I set up the first environmental commission to investigate pollution from the burning of coal in medieval London. The problem of medieval London and of the deadly smogs that killed so many people are now, **" thankfully, a thing of the past"** (*Lees, 1992*). In December 1991 the highest recorded levels of nitrogen dioxide, which can cause breathing problems, were found in London. Most of this gas is produced as a result of vehicle emissions which is probably the major cause of air pollution in urban areas. Other gases include volatile organic compounds (VOCs) produced by the chemical industry.

Emission Limits Setting

Effluents emission limits can be established by taking account of dilution capacity within the receiving waters on the basis that the EQS limits must not be exceeded outside the immediate impact area also called the mixing zone or zone of non-compliance. On the other hand the uniform emission standard (UES) approach sets limits for the concentration of the dangerous substance concerned in the effluent without taking specific account of the available dilution capacity or the presence of other inputs (*Grathorne, 1990*).

Marine Water

The UK accepted definition of Marine Pollution, was the formulated under the Paris Convention, " ... *Marine Pollution is meant the introduction by man, directly or directly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as hazards to human health, harm to living resources and to marine ecosystems, damage to amenities or interference with other legitimate uses of the sea." (GESAMP)*

The UK government attempts to base any pollution control decisions on the quantifiable aspects of the above definition of pollution, and seeks evidence that "pollution" by substance/substances under consideration exists before agreeing to measures to reduce the amount discharged into the Maritime area, i.e. the formulation of an Environmental Quality Objective (EQO), a standard for that component of the ecosystem which will be the most affected by the discharges. If it is so affected that this standard will be exceeded, *"hazards to human life or harm to living resources.... etc."* might occur, then in other words pollution exists, and measures should be taken to eliminate/reduce this problem *(GESAMP)*. In the case of ***"oil pollution"*** the problem is made even greater in

European waters since the "black list" contains the category "persistent oils and hydrocarbons of petroleum origin" whilst the "grey list" contains the category "non-persistent oils and hydrocarbons of petroleum origin".

7.3.6 Environmental Protection for UK Oil & Gas Industry

As early exploration coincided with the discoveries in the remote central part of the North Sea, the environmental protection interests did not seriously begin to attempt to place forces on the licensing process until the 7th Round of licensing was announced in December 1979. In announcing Round 7 the Secretary of State stressed the need to give new impetus to the licensing policies and to encourage exploration in deeper waters but invited interested bodies to give their view on the exploration and development areas which needed ***'special care for environment'***, *(Francis, 1992).*

The Department of Trade and Industry (DTI) agreed the imposition of special oil spill contingency plans on the oil drilling operations within 25 miles of the coast and environmentally sensitive blocks, the West Shetland Basin and Rockall Trough. This arrangement was carried forward into the 8th round of licensing in 1982. The year 1988 was marvelled by fatal incidents that also resulted in reduced production. The Piper Alpha tragedy, which resulted in the loss of 167 lives, mid-year, was later followed by the fire on the Ocean Odyssey and the loss of a further life. These incidents refocussed attention upon safety and environment. The DTI has stringent safety requirements and carries out rigorous inspection programmes involving all offshore activity.

The oil industry inevitably attracts considerable public attention as a potential major polluter of the environment, with continued media coverage of oil spills and their unfortunate, photogenic victims, oil birds. The size of the area affected by discharges of oil from activities, together with the duration of known effects and the uncertainty about long-term effects, are subjects of concern. Until recently, oily cuttings have represented an important input of oil to the North Sea. A consequence of this is that some fish caught in the vicinity of platform have been contaminated by oil from drilling muds. Produced water is expected to make an increasingly greater contribution to the total input of oil, while improvements in cutting cleaning technology and the types of oils used have led to reductions in this source of input in recent years.

Of greater concern are the quantities of oil from illegal discharges by ships and from incomplete gas flaring on oil platforms. Oiled carcasses of birds are still found in abundance along North Sea coastlines and may serve as indicators of pollution levels. However, experience has demonstrated that the upstream offshore industry has a very good environmental protection record, which can be maintained by good communication and collaboration, rather than conflict. It is vital that developments proceed within a well organised, collaborative structure involving all agencies and individuals with expertise to contribute (*Johnston, 1992*).

There is no question that oil activities in such inshore, sensitive areas will produce added threats to marine life and other users of the areas, notably fishing activities, but it is important that priorities for protection are based on genuine scientific and economic criteria, and not the excessive power of specific pressure groups. However, the 1990s have seen a considerable increase in the general public's awareness of the environment and its perceived vulnerability. This has encouraged both UK government and pressure groups to look harder at all industries, including the ***oil industry.***

Against this increased public awareness, the industry recognises that a number of its present activities put environmental issues central to management strategy, including:

- Exploration in environmentally sensitive areas.
- Increases in water production within tightening discharge control regimes.
- The final abandonment of offshore installations.

Over the period 1984-1990 there was a decrease of 30% in the total discharges of hydrocarbons owing to reductions in the discharges of hydrocarbons of oil-contaminated cuttings (*ICES, 1993*). Discharges of oil in produced water, however, have increased considerably, and there are still significant quantities of oil from illegal discharges from ships. The release of oil from incomplete gas flaring from oil platforms continues and needs to be quantified.

7.3.7 UK Environmental Management Tools For E&P Industry

Environmental Management Systems (EMS)

The Department of Trade and Industry (DTI) requires that operators of all blocks issued from the 14th round onwards must have and use an environmental management system (EMS). The Department will make increasing use of a management and goal setting approach to environmental matters in future and less of prescriptive discharge standards. This is in line with the Government's new safety management philosophy and with the EC's 5th Action Programme for the Environment.

Environmental Impact Assessment (EIA)

Environmental assessments could be required as a condition under the onshore planning laws and were used extensively in the onshore development of oil and gas facilities, particularly in Scotland in the early 1980s. They were formally introduced in 1988 under the Town and Country Planning (Assessment of Environmental Effects) Regulations and Environmental Assessment (Scotland) Regulations as a direct result of the EEC Directive. ***Environmental Assessment** has been carried out for onshore oil and gas developments such as oil reception terminals and oil and gas processing facilities but are **not generally required for offshore oil and gas developments** *(Grogan, 1992).* However, the UK Government is currently consulting on the regulations needs to put into law EC Directive 85/337. It is expected that the latest European Directive which require compulsory EIAs for offshore developments will be applied to UK this year. See more detail in EC Directive 97/11 above.

However, many operators have well defined operational environmental policies and already recognise the importance of EIA and Environmental Audit in the planning and operation of developments. Major oil companies such as BP, Shell, Total and Marathon continue to produce environmental assessments and audits for their offshore production facilities in the North Sea.

Consequently in addition to its usefulness in the legal and planning context environmental assessment was also recognised as a tool that initiates an environmental management process which should continue throughout the life of a project development. Thus EIA has been used by the industry, in some cases since the mid-1970s, as a systematic way of achieving this. The operators now carry out EIAs as matter of course, using them as an in-house aid rather than simply as a response to external requests for information.

It must be noted however that ***'nearshore licence blocks'*** do have specific requirements for preparation of EIA, in relation to the potential for oil spills during exploration activities. The local planning authority (LPA) with certain exceptions, is responsible for determining a planning application, with or without conditions, for any proposed development in its area. Before doing so, the planning authority has a statutory duty to consult with a wide range of agencies and persons who may have an interest in the particular proposal. The range of consultations varies according to the nature, size, geographical influence and other statutory requirements related to special types of development projects. Many of the earlier proposals for oil-related projects were made in rural areas where the local planning authority was not accustomed to handling projects of such complexity and size.

Given the relatively hostile North Sea environment the industry has managed to maintain a fairly good track record over the past 20 years. However, as installations age or reach the end of their projected service lifetime, a further round of decision making will be required and the associated risks of catastrophic failure of any installation will need to be continually assessed. Prudence and good housekeeping must be the operational watchwords for the remaining years of North Sea oil and gas production if a reasonably clean record of environmental management is to be accorded to the industry at the end of the day.

Environmental Impact Monitoring

The UK Government has been less demanding in it requirement operators of the UK sector of the North Sea to monitoring the environment almost from the outset of North Sea offshore oil & gas developments, although, the Norwegian Government has been more demanding. In the 1970s and early 1980s there was **no statutory requirement *for an operator to monitor the environmental impact of offshore developments in UK waters*** (*Grogan, 1992*). It was only in 1984 that under Section 23 of the Prevention of Oil Pollution Act 1971 requiring ***seabed monitoring*** when ***oil base mud is used in offshore drilling operations*** were formally introduced in the UK and then only in terms of ***chemical contaminants***.

The seabed sampling programme is required to monitor (usually for hydrocarbons) the environmental effects around the installation during the drilling phase of the development. Further chemical and biological sampling may be required if in the event of unusual levels *(DTI(2), 1993)*. However, many companies had previously initiated their own programmes of pre-operational surveys and monitoring. In the UK the main requirements for offshore monitoring programmes were established under exemption conditions issued under Prevention of Oil Pollution Act 1971 as amended and the Petroleum and Submarine Pipeline Act 1975. These establish requirements for monitoring programme in related to discharge of OBM contaminated cuttings and discharge of produced water.

The need to identify and mitigate the E&P industry's environmental impact became a policy priority after the fourth licensing round in 1971 *(Sweeting,1994)*. Amidst rising concern about the general state of North Sea pollution from all sources. From these early days the commitment to sound environmental management in E&P industry has been higher than in most other industries *(Sweeting,1994)*.

Unlike the new measures the UK has ***no direct monitoring of effluents***, either chemical other than for 'total oil' or toxicity (*Jonston,1994*). There is, however, considerable danger in setting an over-prescriptive environmental control regime offshore (as is happening under the Environmental Protection Act 1990 onshore), and at present many would rather see industry take a more proactive stance involving the introduction of environmental risk analysis procedures supported by cost-benefit analysis techniques. Although there was no statutory requirement, operators in UK sector generally undertook extensive voluntary monitoring of the chemical and biological parameters of seabed sediments to evaluate the environmental effects of drilling cuttings discharges and most of the larger operators still include biological work in addition to their statutory obligations. Water column studies carried out to date have concentrated on water chemistry with some attention to microbiological, plankton, fish or mussel studies. The updated 1992 monitoring regulations from the DTI set guidelines for drawing up of seabed sampling and analysis.

- Pre-operational "baseline' surveys are required, including a benthic community survey which must be approved by the Fisheries Department concerned.

- A chemical survey is required one year after the commencement of drilling, or drilling of five wells, whichever is the longer duration. After this chemical surveys must be undertaken every two years or further ten wells drilled, which ever takes longer. If the results are deemed to warrant it, further surveys of greater detail may be ordered.

- In each survey, the top 1-2 cm only is to be sampled, with at least one sample at each station. Stations are to be located as radial transects, approximately 200, 500, 800, 1,200, 2,500 and 5,000 m from the platform flowing the direction of the residual current. As a comparison, three uncontaminated control stations are to be included, located at least 6,000 m from the platform, including one at 8-10,000 m.

- Ecological monitoring of the macrobenthic community is to be undertaken using the same stations as for the chemical monitoring.

- National marine and estuarine monitoring requirements are reviewed by the Marine Pollution Monitoring Management Group.

(Applied from Sweeting,1994)

Future Guidelines

In November 1996, OSLO and PARIS Conventions for the Prevention of Marine Pollution ad HOC Working Group on Monitoring (MON) drew up draft of 'OSPAR Guidelines for Monitoring Methods to be used in the Vicinity of Offshore Oil and Gas Installations' which was presented by Norway. The purpose of these guidelines is to provide a tool for National Authorities to carry out an effective monitoring of the Maritime Area with the aim of detecting the effects and extent of discharges, emissions and losses of oil and chemicals from offshore installations. In the monitoring of effects of the offshore activities on the ecosystems in the Maritime Area, the choice of sampling sites, biological and chemical methods are crucial inter alias when comparing the results of various monitoring programmes.

Baseline Study : Operators should conduct a basic mapping of discharges and concentration levels of pollution due to petroleum activities. In addition, operators should conduct a baseline study in order to determine the level of relevant pollution of organism living in the water column and sea bottom within each field.

Monitoring Type: Monitoring of the water column and pelagic organisms should be carried out at the same stations. All monitoring of the bottom should include both biological and chemical parameters.

Monitoring Frequency :

Drilling Phase
- the first monitoring should take place the year following the start of the drilling.
- the second monitoring should be carried out 2 years after the drilling started.
- subsequent monitoring should be carried out every 3 years.

Production Phase - the first monitoring should be carried out 2 years after the drilling has ceased.
- subsequently monitoring should be carried out during the production phase.

Phasing-out period : two complete monitoring programmes should be carried out at 3 year interval as soon as the production phase it terminated.

Sampling Stations :

a) Baseline Study

Water Column: The sampling stations should at any time be representative for the shelf of concern. Reference sampling stations should be established in areas which are not expect to be influenced by offshore oil activities.

Sea-Bottom: Offshore Installations - The location of the sampling stations should be determined on the basis of mapping of the influence area by means of quantities discharged, and calculations of the expected direction the discharges will take and modelling. The sampling station system should be parallel to the direction of the residual current. The sampling stations should be established in the system in such a way that they include all sampling stations that will be part of the future monitoring programme.

Region - At least 5 regional sampling stations should be established the first time regional monitoring is conducted. They should be located outside the areas of influence of each individual installation.

b) Monitoring

Water Column: The sampling station system established for the baseline study should represent the core of the sampling stations in the monitoring programme. The sampling station system should be extended in case monitoring results.

Sea-Bottom : Sampling stations around an offshore installation should be final i.e. the same sampling stations should be used during all future monitoring.

a) *Choice of sampling stations at individual installations:* The sampling station system should be designed as a orthogonal co-ordinate system (radian transects) with the main axis along the residual current at the sea bottom and one axis pendicular to the former. Most of the sampling stations should be located along the prevailing current directions.

The sampling stations distance from the installation is the distance between the sampling station and the discharge point centre of the installation. The sampling station closest to the station should be located 250 m from the installation. Further down the axis the distance between the sampling stations should increase geometrically. The sampling stations should be the same for biological and chemical samples.

The sampling stations co-ordinate system should be established with the main axis along the residual current direction. The reference sampling stations should be at least 10,000 m from the installation. The complete co-ordinate sampling station systems should have 3 reference sampling stations. One should be on the 180^{O} axis, the two others should to the extent possible be chosen in such a way that they are located in areas which are expected to be unaffected by discharges in the region. There should always be one unaffected sampling station along each of the 4 axis.

b) Regions : A regional sampling stations system for monitoring of bottom sediments should be established outside the presumed influence area for existing and planned petroleum activities in addition to the local sampling stations. At least 5 sampling stations should be established in each of the regions. The sample from these stations should be analysed using the same parameters as the samples taken round single installations.

c) Reference Sampling Stations : There should be a minimum of 3 reference sampling stations for each field/ installation and they should have approximately the same type of sediments and depth as around the relevant installation. Ten replicate samples should be taken (grab samples / core samples) for biology and 5 for chemistry.

d) Standard Parameters : *Parameters of Water Column and Sea-Bottom* should be include biology, hydrocarbons, metals and sediment (for Sea-bottom) *(Adopted from OSPAR, 1996).*

Contingency Planning and Pollution Response

SI 1976/1542 requires that every manned offshore installation have an Emergency Procedure Manual specifying actions to be taken an emergency, including a well blow-out and a leak or spillage of any oil or gas. All escape of petroleum from an offshore installation must be reported to the DTI and where it escapes into the sea, to the nearest HM Coastguard Station. All spills grater than 1 tonne should also be reported to the Joint Nature Conservancy Council (JNCC). Petroleum Licence, Clause 20 (8), requires the licensee to report any event causing escape or waste of petroleum. The Emergency Procedure Manual is set out by DTI (1979) in Annex 2 of the continental Shelf Operators Notice No.7. The details are shown as:

- In general, any oil spilled from an offshore installation should be tracked and the incident reported to the appropriate authorities. Dispersants should be sprayed without delay and without consultation with government bodies if it is a safety hazard.

- If a spill occurs at an installation operating in any blocks wholly or partly within 25 miles of the coast, and/or if it is clear to that there is an identifiable threat to any vulnerable environmental interest or resource requiring protection (such as fishing operations) then the operator should carry out such spraying as is necessary to allay the threat, and advise HM Coastguard accordingly.

- Where the spill is, or may become, extensive (e.g. a blow-out) there should be the earliest possible consultation with the Department of Transport and other interested government bodies. Where a spill is limited in size and not ongoing there is no need to engage the DoT in urgent consultation, and except for reasons of safety or to protect an environmental resource of interest, the use of a dispersant is considered unnecessary.

- An event such as a blow-out requires immediate action and often the mobilisation of considerable resources for regaining well control. In these circumstances there are arrangements for the establishment and liaison with a government Blow-out Emergency Team.

- The use of dispersants at sea is controlled by Part II of the Food and Environmental Protection Act 1985 and paragraph 21 of the Deposits in the Sea (Exemption) Order 1985. The user does not require a licence under these requirements to apply dispersant provided the following conditions are fulfilled:

    1. the product used is one which is currently approved by the licensing authority (MAFF or SOAEFD);
    2. it is used in accordance with any conditions to which the above approval was subject;
    3. it is not used in an area of sea of a depth of less than 20 m or within 1 mile of any such as, same with the approval of the licensing authority.

Environmental Auditing

There are currently no statutory requirements for Environmental Auditing. In line with the best industry practice and company policy Auditing must be undertaken following guidelines in the current draft European Directive.

7.3.8 Institutions Concerned with UK Environment Protection

1) Department of Environment, Transport and the Regions (DETR)

The DETR works to improve the standard of the environment by promoting a responsible attitude towards the environment, spreading ideas of good environmental practice, increasing scientific knowledge and public awareness of the state of the environment and creating a framework for environmental protection and enforcing them.

2) Environmental Agency (EA) / Scottish Environment Protection Agency (SEPA)

Part I of the 1995 Act established the new Environmental Agency (EA) for England and Wales and the Scottish Environment Protection Agency (SEPA) for Scotland. The EA / SEPA started work on April 1996. The EA brings together the functions of HM Inspectorate of Pollution, the National Rivers Authority and local waste regulation authorities. SEPA bring together the functions of HM Industrial Pollution Inspectorate, the River Purification Authorities, and the responsibilities of district and islands councils in respect of waste regulation and local air pollution controls.

The Environmental Act 1995 set up these new environmental agencies with powers to control and prevent pollution to land, air, and water. The Agencies offer a *'one door' approach* to industrial pollution control by removing the former overlap of regulators *(Scottish Office, 1995).* The Act provides the appropriate environment authorities, EA /SEPA, to serve a notice on potential polluters or polluters requiring them to carry out works to prevent or clean up water pollution. If the person on whom the notice is served fails to comply with any of its requirements, the appropriate authority may still use existing power under the 1991 Act to carry out those works and seek to recover its expenses.

In particular the recently formed Environmental Agency has a programme of work in environmental risk assessment, aimed at addressing some of the new duties of the Agency, such as contributing to sustainable development, ensuring integrated environmental protection and maximising regulatory efficiency. Some of these developments will be of interest to the offshore industry and will be highlighted, especially risk assessment, which was identified as a key principle in the Government's sustainable development strategy *(DOE, 1995)*.

7.3.9 Institutions Concerned with Environmental Issue for E&P in UK

Environmental control of offshore oil & gas operations is shared between four main authorities which are the Department of Trade and Industry (DTI), the Ministry of Agriculture Fisheries and Food (MAFF), the Scottish Office Agriculture Environmental and Fisheries Department (SOAEFD) and the Department of Environment, Transport and the Regions (DETR). Main government authority response for environmental impacts from offshore E&P activities in UK as summarised in Table 7-1.

Table 7- 1 UK Institutions requirements related to oil & gas industry ***(Borthwick et al, 1994)***

Consultants	Requirement
Department of Trade and Industry (DTI)	1. Administers the licensing rounds. 2. All discharges will require the consent of DTI. 3. Agreement must be reached concerning the formulation of drilling muds and disposal. Water based muds are required wherever feasible. 4. An oil spill contingency plan must be consulted to agree six months prior to drilling operations. 5. If after initial exploration, more development drilling is proposed, proposals must be submitted to DTI at least 90 days prior to applying for drilling consent.
MAFF / Welsh Office	1. Must be consulted at least 30 days before seismic survey or drilling exploration, particularly with reference to fisheries. 2. Must be consulted six months prior to drilling operations to agree an oil spill contingency plan. 3. Licensee must appoint a fisheries liaison officer.

Department of the Environment, Transport and the Regions (DETR)	1. To agree an oil spill contingency plan the operator must consulted at least 30 days before seismic survey or drilling explorations.
Crown Estate Commissioners	1. Must be consulted at least 30 days before seismic survey or drilling exploration. 2. Licenses extraction of marine aggregates.
Joint Nature Conservation Council	1. Must be consulted at least 30 days before seismic survey or drilling exploration, particularly with reference to nature conservation. 2. Must be consulted six months prior to drilling operations to agree an oil spill contingency plan. 3. In areas containing an important seabird colony, in order to determine periods during which drilling will be banned.
Ministry of Defence (MoD)	1. If a Block lies within an area of MoD activity, they must be consulted three months before all seismic activity and at least six before all rig movements or prior to any proposed drilling.
EA / SEPA	1. issues consents to discharge within three miles of the coast. 2. Must be given six months notice of drilling proposals to allow formulation oil spill contingency plan. 3. At least 30 days notice of seismic work within three miles of the coast ; may require an environmental impact study of proposed survey or drilling. 4. No drilling will be allowed between June and September within the three miles limit.

1) Department of Trade and Industry (DTI)

1.1) Current Structure and Functions

Structure of DTI related to oil and gas issues can be divided in to three Divisions, Oil & Gas Division(OG), Energy Policy and Analysis (EPA) and, Offshore Supplies Office (OSO). The Oil and Gas Division has five functional sections as bellow. See the structure in Fig. 7- 1 to Fig. 7-3.

- OG1- main duties concern about UK & International Downstream Oil & Gas, Refining & Marketing of Petroleum Products, Emergency Planning, NS Statistic & Taxation;
- OG2 - concern about Licensing, Well records;
- OG3 - *OG3a : Consent Section* - main duties are Production / Flare & Vent Consents, Development Plan Submissions, Oil Pollution, Environment Research & Development, De-regulation for OG3, Offshore Chemicals, International Flora -Environment;

OG3b : Decommission Section - main duties are Decommission, International Fora;

OG3c : Metering Section - main duties are Oil & Gas Metering, Guidelines,Advice Inspections Environment;

OG3d : Field Team 1;

OG3e : Field Team 2;

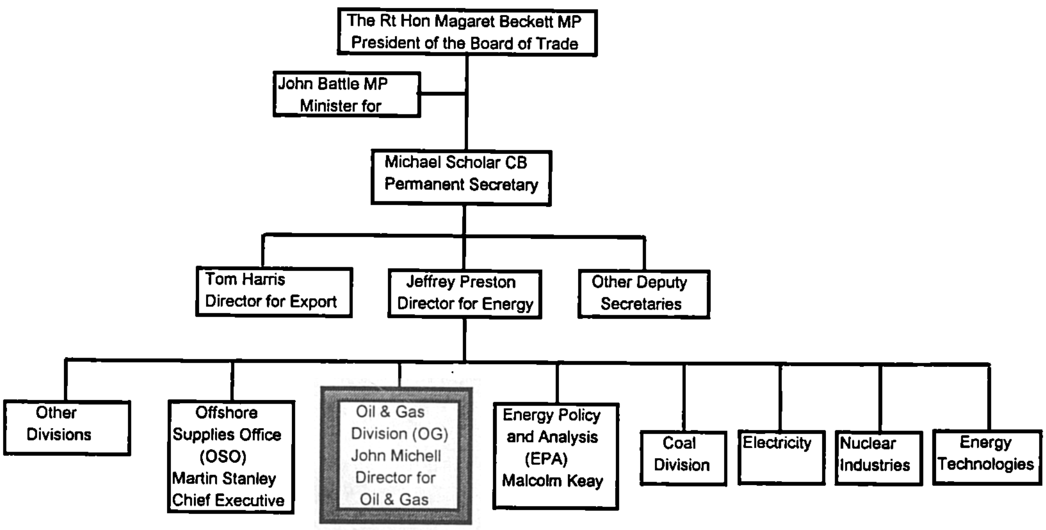
OG3h : main duties are , Reserves Forecast, Develop Policy, Process Transportation Terminals ;

OG3f : Field Teams 3 ;

OG3g : Field Team 4.

- OG4 - response for Royalties, Levy, and ect.,
- OG5 - response for Information Technology (IT).

Fig. 7-1 Structure of DTI (Oil & Gas Issues)



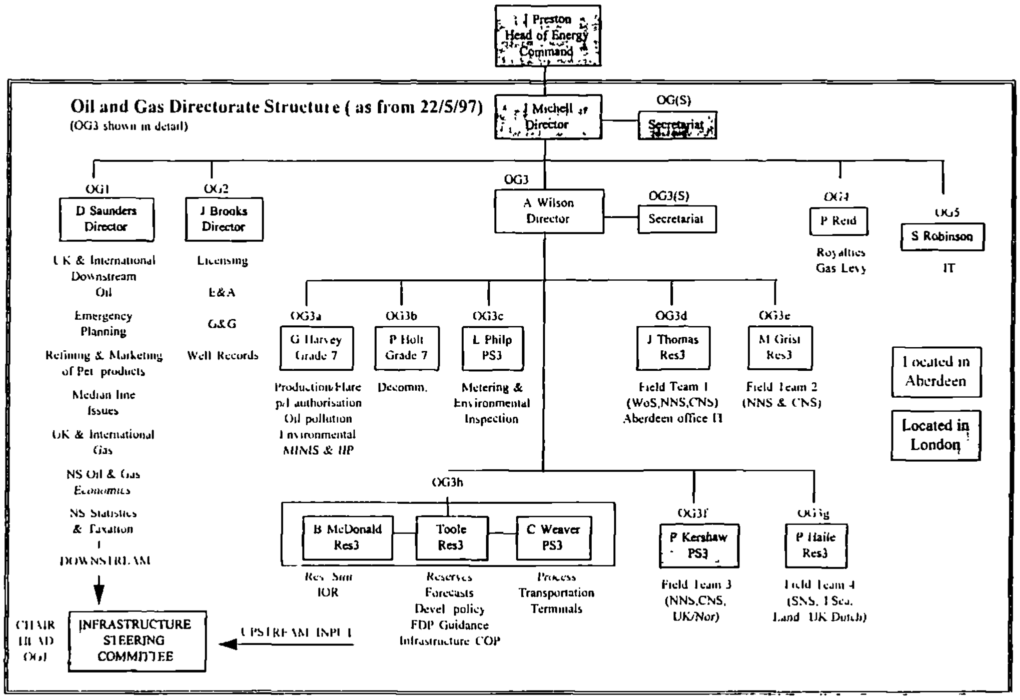


Fig. 7-2 Oil and Gas Directorate Structure ***(DTI,1997)***

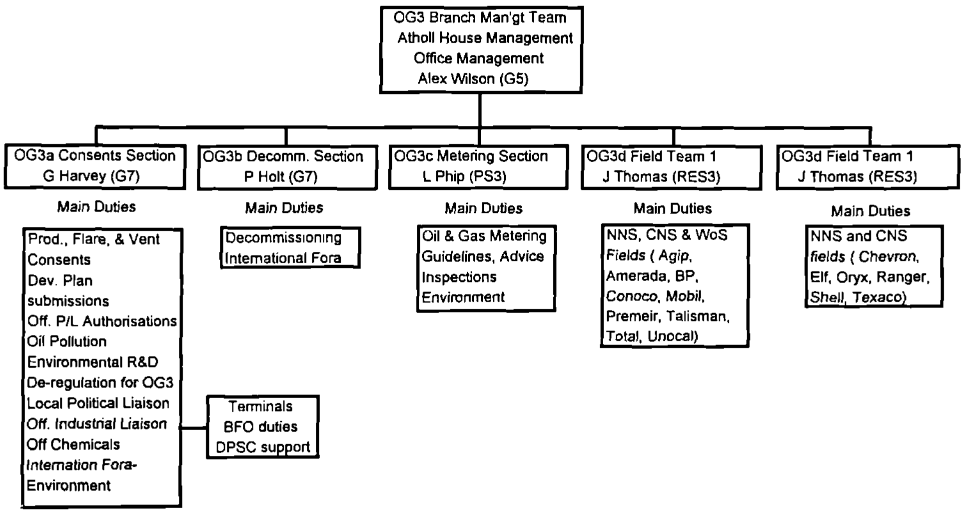


Fig 7-3 OG3 Aberdeen Structure Chart *(DTI, 1997)*

Fig. 7-3 OG3 Aberdeen Structure Chart *(DTI,1997)*

1.2) Environmental control of offshore oil & gas Operations

At present, environmental issues offshore are controlled principally by the Oil and Gas Division of DTI. It is this Department which grants licenses to explore for or get petroleum and is responsible for all the environmental standards which apply to these licences. However, the DTI also works inclose consultation with the two principal government fisheries departments, MAFF and SOAEFD. Other consultees, may include the Department of the Environment, Transport and the Regions (DETR), the Joint Nature Conservancy Council (JNCC), English Nature (EN), Scottish Natural Heritage (SNH) and Local Authorities. Although the DTI is the regulating and controlling department, it does so within a general government consensus.

The overall objective of the DTI's Oil and Gas Directorate is to sponsor and regulate the development of the Crown's resources of oil and gas in the best national interest, having due to regard to the environment and the interests of other land and sea users. In the 1990's, oil and gas are the most important natural resources to be exploited in the UK.

Offshore installations and pipelines are controlled by the DTI, Oil and Gas Division, which licences exploration and exploitation activities and deals with pollution control and abandoned installations. Together with the Marine Pollution Control Unit (MPCU) of the DTER it deals with oil spills, although the UK Offshore Operators' Association has designed sectors in the North Sea for which a "sector club" will co-ordinate the use of the resources held by operators to deal with an emergency. The responsibility for dealing with all oil pollution from the rigs lies with the oil company carrying out the operation and contingency plans must be drawn up for all rigs before the company is given a licence for exploration or production.

Since the seventh licensing round, rather than have an all embracing set of restrictions on oil and gas activities, the government, originally through the DTI, has set specific environmental conditions for individual blocks. These conditions are set only after consultation with other government Departments: MAFF, SOAEFD, DETR and JNCC. This gives a great degree of flexibility in tailoring operational restrictions to meet block specific environmental requirements *(Lummis,* *unknown year).* Before blocks are offered the ***DTI*** consults ***MAFF/ SOAEFD/ JNCC*** and any highly sensitive areas may not come on the market. Subsequently both before and during any exploration and production, oil companies must demonstrate a level of environmental awareness to the DTI. Companies must also have an environmental policy to minimise any adverse effects which their operations may have on the environment and usually compile information to assess the environmental sensitivity of the block.

These are based on a **'sensitivity score'** which takes into account any nature conservation and amenity areas in the vicinity as well as population figures for shell fisheries, coastal birds, seabirds, seals and benthic fauna. The quantity of fish caught from the block is also taken into account so that, for example, areas where more than 10 000 tonnes of fish are taken in a year are considered extremely sensitive (*Gubbay, 1988*). Some areas also have a '***specific Code of Practice'***.

It has been normal practice for the ***DTI*** to include environmental considerations in the various 'Rounds' of licensing for the award of exploration and production licences. This process has both ensured that the applicants provide information on their company's attitude and performance in the area of environmental affairs, and has provided a vehicle to allow the concerns of third parties to be dealt with by means of the special conditions of licence imposed at the time of award. The third parties exist in the form of the fishing and seabed extractive industries, bodies and authorities concerned with inshore and coastal sensitivity issues as well as other Government Departments such as the ***Transport and the Fisheries Departments and the Ministry of Defence (MOD).***

1.3 DTI and Industry Consultation

In order to exercise its responsibilities effectively and with due regard for the consequences of legislation it is essential that government knows what is going on in industry. Government is represented by DTI, DETR, MAFF and SOAEFD and can invite other departments as specific issues dictate. The DTI encourages all operators to make use of this forum by making sure that their environmental representatives are fully briefed on current problems and also that they report back on what is going on in PARCOM and government.

DTI meets individual operators and will discuss specific problems but the main consultation forum is through UK Offshore Operators Association (UKOOA) and the UKOOA / Government Joint Working Group on Environmental Affairs. UKOOA membership is from the Environmental Committee, which is reflecting the importance of offshore discharge to the UK government and PARCOM. The group meets 4 or 5 times a year and is the main focus for the preparation of input to the PARCOM meeting. Whenever possible DTI passes papers to UKOOA for comment and briefing so that industry views can be reflected in the meeting as appropriate.

1.4) Environmental Inspection Framework

DTI, Oil and Gas Division, has 6 inspectors (4 Engineers and 2 Environmental Scientist all of them from Aberdeen Office) for offshore E&P platform inspection on average about five platforms are inspected per month. The inspection is scoped by confidential Checklist Inspection Forms, which have two sections: Section A (use for one day) and Section B (use for more than one day checklist).

Section A covers main issues about Indication Oil Spill, Discharge, Produced Water, Chemical Storage, Well Testing (Flaring,etc.), Drill Floor (to check about mud loss to the sea), Oil Spill Contingency Plan, Produced Sand. Cutting or drilling mud checks are not included in this Section, because of its banned discharge to the sea. *Section B* covers the main issue about Audit of Chemical, Oily Water Draining System, Oil Spill Prevention, and Flaring. DTI will have a spot check and take sample only sometime, some case, not their routine work. Because of lack of facility, such as helicopter, to go to offshore platform by their own. No DTI's inspector stand by (24 hrs.) at the site operation.

In summary there are four environmental management tools which are used for offshore oil & gas operation by DTI: Baseline Study, EIA, Checklist, and Monitoring. Baseline Study will only be made for new areas. EIA is under licensing conditions. At present there has only been one formal EIA, which was required by Act by 'within 25 miles from shore condition'. Checklist is a routine job, which is one part of auditing. Monitoring will be made only as a case by case basis. By now DTI have no plan to do any big monitoring by their own (1995 was the last year). Because more than 100 of monitoring reports had done and get the same result, also the cost is so high.

(Note : *this information source came from an interview with Senior Environmental Manager of Oil and Gas Division, Mr. Kevin O'Carroll)*

7.3.10 Environmental Regulation for Offshore E&P industry

Every phase of the oil & gas industry is controlled under international, EC and UK legislation. There is a large and growing body of legislation surrounding the environmental affairs of industry which affects UK offshore oil and gas industry and their supporting activities. This generally exists in the form of International Conventions/ Agreements, European Directive, UK Acts of Parliament and Regulations, as well as wide ranging non-statutory guidance notes, etc. There are 29 international laws (since 1954), 44 EC laws (Directives /Decisions /Regulations)(since 1967) and 117 UK Statutes (*35 Act, 62 Regulation, and 20 order*) related to environmental management for upstream oil & gas industry (counted from the UKOOA Oil & Gas Industry, Environmental Legislation Guide in 1993) *(ERT, 1994).*

The standards accepted in North Sea were initially established by the *Paris Commission* under the auspices of the 1974 Paris Convention and are under constant review by the Commission (OSPARCOM 1985). Most of UK standards are originated from the EC but principally from the Paris Commissions. Environmental concerns, identified by discharge or emission reporting, field surveys or R&D programmes are brought to the PARCOM meetings as proposals or general discussions topics. The standard are usually agreed by consensus and must then be expressed through UK legislation and regulations. Most of environmental issues offshore are controlled directly and exercised by DTI (the regulatory body). It is however, in some issues administered by other government departments.

1) Legislative and Other Controls Exercised by DTI

The Petroleum (Production) Act, 1934

The Petroleum (Production) Act, 1934 (in force 12 July, 1934) vested in the Crown the property in petroleum "... existing in its natural condition in strata in Great Britain..." and accorded to the Crown" ... the exclusive right of searching and boring for and getting such petroleum". It is also provided for the issuing of licences to other persons to search for and get such petroleum. Licences for the exploitation of petroleum are issued by the Secretary of State for Trade and Industry. Model clauses attached to a licence for an offshore installation contain a requirement that the licensee must conduct the operation without interfering unjustifiably with the fishing or conservation of living resources of the marine environment. In addition operations must be conducted in a way that prevents oil escaping and entering the sea.

Petroleum (Production) (Seaward Areas) Regulations 1988

The Act prohibits operations to interfere unjustifiably with the marine environment of the UK Sector of the North Sea. The Regulation cover the disposal of gas by flaring (or unignited release) - this requires the written consent of the Secretary of State; the avoidance of harmful methods of working (prevention of the escape or waste of petroleum) and of interference with fishing and navigation.

Hydrocarbons Licensing Directive Regulations 1995

Under Section 4 of the Regulations limit the terms and conditions which may be imposed on the grant of a licence. Considerations include public health and safety, environmental protection and protection of biological resources and of national treasures possessing artistic, historic or archaeological value. The Secretary of State is required to make available to interested parties the terms and conditions upon which any licence will be granted.

2) The Continental Shelf Act, 1964

The Act (in force for the whole of the UK on 15 April, 1964) provided for the exploration and exploitation of the shelf; it vested in the Crown *".... any rights exercisable by the UK outside the territorial waters with respect to the seabed and subsoil and their natural resources, except so far as they are exercisable in relation to coal ...".* It extended the provisions of ss. 2 and 6 of the Petroleum (Production) Act, 1934, to any petroleum with respect to which these rights are exercisable. It further required that the model clauses prescribed for licences must include provision for the safety, health and welfare of persons employed in the licensed operations. Subordinate legislation under this Act specifies, inter alias, sea areas as safety zones for the protection of installations, regulations concerning licences and model clauses to be incorporated in them.

3) Prevention of Oil Pollution Act (POPA) 1971 and 1986

This Act, Section 2 and 3, prohibits discharge of oil or any mixture containing oil into any part of the sea in UK Territorial Water or beyond territorial water in the sea over the continental shelf as the result of discharges from pipelines and any operation for the exploitation of the sea-bed and sub-soil or the exploitation of their natural resources. Nevertheless, the Secretary of State does have a judgement to grant exemptions from this ban on discharges of oil into the sea. However, this Act was replaced by the 1983 regulations but remains in force *(Kimber,1994:6).* The main requirements of the Act as follows:

- Produced Water Exemptions : PARCOM - derived standard 40 ppm,
- Oil Based Mud Exemptions : a) PARCOM - derived standard 10 g/kg oil on dry cutting,

  b) UK - derived standard for seabed surveys and sample analysis,
- Other oily discharges - UK - derived conditions, case by case,
- Powers to prosecute for oil spills.

4) The Mineral Working (Offshore Installations) Act, 1971

The Act provided for the safety, health and welfare of persons on installations, in territorial waters and the superjacent waters of the continental shelf, who are concerned with the underwater exploration and exploitation of mineral resources. Operator is required to notify the Ministry and EA/SEPA of any event causing the escape or release of petroleum. The Act requires for Oil Spill Contingency Plan. This is administered in consultation with the Marine Pollution Control Unit of Department of Environment, Transport, and the Regions.

5) The Petroleum and Submarine Pipe-lines Act, 1975

The Act applied to pipe-lines in **'controlled waters'**, which are defined as " ... the territorial sea adjacent to the United Kingdom and the sea in any designated area within the meaning of the Continental Shelf Act 1964 [Section 20(2)]. It provided for the establishment, constitution and functions of the British National Oil Corporation (BNOC), modified earlier legislation on model clauses, regulated the construction, use and safety features of pipelines in certain waters surrounding the UK and regulated the construction and extension of certain refineries, Section 1-16, 17-19, 20-23 and 34-39 respectively. A pipeline requires protection, trenching or burial as a measure against environmental influences which can also threaten the integrity of the system. The Act was formulated to give the Secretary of state the power to exempt such discharges from the prohibition of the 1971 Act. To receive exemption operations must use ***the best practicable*** means available to reduce the oil content of the discharged waters.

6) The Energy Act, 1986

To date there are no special environmental controls on gaseous emissions for offshore installations. The flaring and venting consents issued by the DTI are for resource conservation reasons.

7) The Petroleum Act, 1987

The Act in addition to making provision for the preparation and implementation of programmes for the abandonment of offshore oil and gas installations and submarine pipe-lines at the end of their production lifetime. It also provides for the automatic establishment of safety zones around offshore installations. This Act may make provision for prevention of pollution, for inspection and, for the determination of the amount of any fees payable to the Secretary of State.

2) Other Legislation with Environmental Implications not Administered by DTI

Other both routine and non-routine offshore operations may require oversight or consents for environmental reasons which are exercised or issued by other government bodies as follows;

1. Food and Environment Protection Act 1985

The main point of the Act is concerned about non-operational discharges of chemicals and other wastes. Departments responsible are the Ministry of Agriculture Fisheries and Food (MAFF) or the Scottish Office Agriculture, Environment and Fisheries Department (SOAEFD).

Part II of this Act gives power to regulate all 'non-oily' discharges and disposals to the sea. The Act requires for license to dump materials into or under the sea or to incinerate materials at sea. This covers protection of fish etc., for human consumption, from contamination by dumping; controls on the use of dispersants; controls on the dumping of synthetic materials.

Currently all E&P chemicals used as a consequence of normal operations are controlled by Offshore Chemical Notification Scheme (OCNS) 1996. Revised in accordance with requirements of the OSPARCOM Harmonised Offshore Chemical Notification Format (HOCNF). Thresholds are stipulated for the notification of certain chemicals with respect to their discharge levels. Within 3 mile limit the control of Pollution Act 1974 (Scotland) or the Water Resources Act 1991 (England and Wales) apply but these are not administered by DTI.

2. Environmental Protection Act 1990 (EPA 1990)

A systems of Integrated Pollution Control (IPC) for air, water, and land pollutants from certain process was introduced by this Act, Part I. Also establishes the concept of Best Available Techniques Not Entailing Excessive Cost (BATNEEC). Offshore operation installations connected to terminals by pipeline can be affected by these Act. In Part II of the Act require about Duty of Care for handling and disposal of wastes from offshore installations. The government body exercised by Environment Agency (EA) (for England and Wales) and Scottish Environment Protection Agency (SEPA).

3. Radioactive Substances Act 1993

Authorisation required to accumulate and dispose of radioactive waste except where a nuclear site licence is in force. The government body exercising this Act is EA / SEPA.

4. Environmental Act 1995

Section 93 to 95 provide for enabling legislation for the introduction of regulations to impose 'producer responsibility' obligations in order to secure an increase in, or to sustain at least a minimum level of, the reuse, recovery or recycling of any product or material. The powers are applicable to any waste stream. The new contaminated land provisions in Part II clarify the existing position under statutory nuisance and introduces additional protection for owners in terms of limitation of cost recovery. They implement the 'polluter pays' principle, but recognises that the land owners of land are also responsible for certain aspects of its condition if the original polluters cannot be found.

5. *Merchant Shipping Act 1995*

This Act consolidates the Merchant Shipping Acts 1894 to 1994 and other enactments relating to Merchant Shipping. The regulatory body is DETR and MSA. The Act, under Section 131, makes it an offence to discharge oil or a mixture containing oil into UK national waters which are navigable by sea-going ships from a ship but takes a place in the course of a transfer of oil to or from another ship or place on land. The Act, Section 130, allows the Secretary of State to make regulations in relation to the transfer of cargo, stores, bunker fuel or ballast between ships while within UK waters, such provision as he considers appropriate for preventing pollution, danger to health or to navigation, or hazards to the environment or to natural resources. Also the Secretary of State has a power to grant exemptions from any of the provisions relating to oil pollution or any regulations made there under.

Merchant Shipping (Prevention of Oil Pollution) Regulations 1996

These Regulations give effect to the provisions of Annex I of MARPOL 73/78. Any discharge of oil or oil water mixture from ship into the sea must comply with the requirements of Part 3 of the Regulations. The regulatory body is MSA. The discharge from an offshore installation of oil or oily mixtures with an oil content of > 15 ppm is prohibited by the Regulation 82. Oil and oil mixtures means discharge associated with platform drainage and does not include production or displacement water discharge.

The Regulations, Part 7, make particular provision for offshore installations(in principle considered as vessels of 400 GRT or above) and requires that where practical they be equipped with similar systems and oil retention tanks required by Regulations 14 and 25(1) and (2). The Regulations also requires the operator to keep a record of all oily water/ oil discharges.

6. Merchant Shipping and Maritime Security Act 1997

Section 1 of the Act give powers to the Secretary of State to identify a 'temporary exclusion zone' around a ship or structure which due to being wrecked or damaged may cause significant harm. The Act ,Section 10, also gives powers to the Secretary of State to move ships on if they pose a threat to safety or the environment. The regulatory body is the DETR and MSA.

7.3.11 Control Over Discharges from Offshore Installations

The legislation concerning pollution from offshore installations mainly covers aqueous discharges, disposal of solid waste to the marine environment, atmosphere emissions, and includes accidental events, which is an important issue. Discharging from these activities during operations are covered by several international conventions which have, in large, been implemented in the UK by various Acts of Parliament and Regulations. Various aspects of offshore operations are governed by other UK statutes. These impose requirements on operators and provide for penalties in respect of: discharges containing oil, spillage of oil, contingency plans for oil spills and other emergencies, disposal of solid waste, discharges associated with the commissioning or repair of pipelines, abandonment / decommissioning of installations.

1) Oil Based Mud (OBM), and OBM Contaminated Cuttings

The Prevention of Oil Pollution Act 1971 requires that "where oil is added to water based muds the conditions attached to the exemption state that the additional of oil should be avoided wherever possible, and when it is used should be justified on geological, safety and/or economical grounds and logged. The exemption imposes the following conditions on production and development drilling operations using approved "low toxicity" oil based muds:

1. Use of diesel based drilling muds is prohibited for all wells drilled.
2. For all wells (exploration, appraisal, and development) a justification must be made for the use of Oil Based Mud.
3. To be acceptable as a low toxicity base oil mud the system must have been subject to toxicity testing (given in Annex 1) and shown to have an acceptable low acute toxicity.
4. No whole OBM mud shall be discharged.
5. All discharges must not exceed the standard of ***10g oil/kg dry cuttings***
6. Exemption is required under S23 of POPA for the discharge of OBM contaminated cuttings.
7. Chemical use within the mud is subject to restrictions
8. Oil content must be determined at least once per day or per 1000 ft drilled
9. Qualitative & quantitative check analyses must be carried out as required
10. ***For each production or development well drilled with OBM,*** samples must be taken from the lowest section, not the pay zone which is being drilled

- sample of cuttings for analysis by usual retort method offshore.
- a 2.5 litres of cuttings taken for analysis by

  - GC for total hydrocarbons,

  - GC for qualitative aliphatic profile,

  - GC-MS for quantitative 2-6 ring aromatic compounds
- a 2.5 litres sample of mud from the active pit, for analyses as above
- a 1 litre sample of base oil- *not mud supernatant* - used to formulate the mud in use in the active pit, also for analysis as above.
- cuttings, mud and base oil should store in unopened containers.
- representative 100g sub-samples of cuttings and mud should be removed fully, and stored at -18°C or below prior to analysis
- the remainder of the samples should be stored at 0-5°C until DTI has notified the operator that they are satisfied with the analysis or ask for further analyses and/or toxicity tests

- the results of the cuttings and muds analysed should be passed to the DTI within 30 days of sampling

11. The analysis results of oil contents of cuttings discharged must be submitted to the DTI within 14 days of the completion of the well.
12. The seabed sampling programme is required to monitor the environmental effects around the installation during the drilling phase of development.
13. no requirement for seabed sampling, or detailed analysis of cuttings for Low Toxicity OBM in exploration and appraisal drilling
14. Drilling within 30 nautical miles of the coast or in specially sensitive areas using OBM, DTI will consult with the relevant Fisheries Department before drilling commences. ***(Source:** applied from DTI,1993, Conditions for the Discharge of Oil Contaminated Cuttings Resulting from Offshore Drilling.)*

In the other hand, UKOOA Member Companies are determined to continue to reduce oil inputs from drilling operations and are confident that they will be successful. This can be achieved by upgrading the performance of existing equipment and may not require expensive equipment replacement or the use of solvent cleaning techniques. UKOOA believes that future effort should be aimed at reducing the **'total quantity'** of oil discharged rather than focusing on further reductions of the **'concentration'** of oil on cuttings. Studies carried out by UKOOA indicate that the installation of solvent cleaning equipment on offshore platforms would be very costly and would not contribute significantly to an improvement in the environment.

2) Mineral -Oil-Like Synthetic (SBM) Or Pseudo Oil- Based Muds (POBM) Contaminated Cuttings

The UK has now fully implemented PARCOM decision 92/2. This decision reduced and now prohibits conventional mineral oil-based cutting discharges at more than 1% oil -on-cuttings from 1/1/97 for all wells drilled anywhere on the UKCS. The discharge of synthetic mud contaminated cuttings on the UKCS will be reduced to effectively zero by 31/12/2000. The company will reduce its discharges by at least 20% each year using a 1996 baseline in order to achieve the deadline by 2001 (except ester based muds). Any oil contamination before discharge of cuttings will required exemption from POPA 71 *(**Source:** applied from DTI(2), 1997).*

3) Drilling Cuttings/ Water Based Mud (WBM) Contaminated Cuttings

Prevention of Oil Pollution Act (POPA) 1971, Section 23, (with amendments) requires that in all instances where oil is added to WBM only approved low toxicity oil should be used and returned to shore for disposal. It is an offence to discharge any oil/ mix containing oil in UK waters without the exemption of the Secretary of State (subject to conditions). Exemption from FEPA 1985 is given for routine discharges originating from a marine structure. Chemical use within the mud is subject to restrictions *(**Source:** applied from DTI,1993, Conditions for the Discharge of Oil Contaminated Cuttings Resulting from Offshore Drilling.)*

4) Chemicals used offshore

Exploration and production (E&P) chemicals for use on the UK continental shelf (UKCS) will operate in accordance with the requirements of the Harmonised Offshore Chemical Notification Format 1995 (HOCNF) as published by the OSLO and Paris Commissions in 1995 (OSPARCOM)*(DTI(2),1996).* The OSPARCOM have overall responsibility for regulating the discharges of chemicals offshore, via an international agreement. During the third North Sea Ministers Meeting in 1992, there was agreement on oil discharges, with the Ministers now charged with the development and implementation of a mandatory and harmonised control system for discharges containing chemicals. Permissible chemical discharges to sea are controlled by the DTI Notification which were agreed on a harmonised mandatory control system for use and reduction of the discharge of offshore chemicals. The Department publishes a list of notifiable chemicals which is used as a basis for selection of chemicals on platforms.

The format required for the testing and reporting of all chemicals used by the offshore oil & gas industry throughout the entire North East Atlantic Sector. Includes all chemicals (exempt chemicals used solely within the domestic accommodation areas of an installation) used in drilling, completion, stimulation and operation of a well and chemicals used to treat all fluids produced from a well. Chemicals for use on the UK offshore E&P will be classified into 'groups' based on their potential biodegradation, bioavailability and toxicity to a range of taxonomic groups by using protocol and test species approved by OSPARCOM. Data must be submitted using the HOCNF Pro-forma in order that the classification process can be made accurately and rapidly.

This HOCNF approach is a considerable improvement on the non-statutory Notification Scheme for the Selection of Chemicals for Use Offshore (OCNS), which had operated since 1979. The categories in OCNS were solely dependent on acute toxicity to *Crangon* species; the HOCNF considers a much broader suite of ecotoxicological parameters (above), but still makes the simplifying assumption that all the chemical **used** on a particular platform is **discharged** to the marine environment. Since 1992 operators in the North Sea have been working with chemical suppliers and researchers on the CHARM (Chemical Hazard Assessment and Risk Management) model (Schobben HPM, Scholten MCT, Vik EA and Bakke S, 1994, CHARM *: An environmental risk evaluation model for offshore E&P chemicals*). The basis of this approach is a comparison of the predicted environmental concentration (PEC), calculated from use concentration and fraction released, with a no observed effect concentration (NOEC), derived from toxicity data. the PEC/NOEC ratio is determined for three environmental compartments, water column, benthos and food chain, by considering the distribution of chemicals between water, sediment and biota, and comparing this with toxicity to an appropriate organism. If any PEC/NOEC ratios are greater than unity then there is the potential for undesirable effects on the environment; values less than one should have no consequences. The output from the model should, therefore, be useful in choosing safer chemicals.

5) Production Water / Displacement Water

The discharge of produced water in the North Sea is governed in international law by the 1974 Paris Convention on the Prevention of Marine Pollution from Land-based Sources. In 1988, PARCOM reiterated that the ***40 mg/l*** standard for oil discharged in produced water should apply to ***all platforms***, that best available technology (BAT) should be used to treat produced water, and stated that reports should be submitted to a Working Group on Oil Pollution (GOP) on platforms failing to meet the discharge standard. In UK, under the Petroleum and Submarine Pipeline Act 1975 (PSPA 75), the operational need to have a permit to discharge of oily water. The Prevention of Oil Pollution Act 1971 (POPA 71) together with its amendments, applies to discharges of production and displacement water containing oil, and offshore processing drainage water. Under POPA 71 Section 3, it is an offence to discharge any crude, fuel, lubricating, and heavy diesel oil, or oil produced directly or indirectly from crude oil.

The POPA (amended) allow the Secretary of State to exempt offshore operators from the provisions of Section 3 subject to such conditions as he thinks fit. Such exemptions are granted on a case by case. In taking such powers the Secretary of State gave an assurance to Parliament that exemptions would only be given when the best practical means available were to be employed to reduce the oil content of the discharged water to a minimum. The conditions imposed derive from limits agreed in the Paris Commission. For **produced water in excess of 2 tonnes**, operators have been required to meet on:

- average a discharge standard of less than 40 ppm (mg/l),
- The average is taken on a monthly basis, during which time no more than 4% of the samples should have any oil content greater than 100 ppm,
- Two samples are analysed daily. (Inspectors of the Department of Trade and Industry (DTI), have power to take samples and have them analysed independently),
- a monthly report is submitted to the DTI.

At the third International Conference on the protection of the North Sea, in 1990, it was agreed to investigate the technical feasibility of a reduction from 40 to **30 mg/l** in oil content of production and displacement water discharged from existing and new offshore installations *(ICES, 1993)*. E&P forum (1994) reported that in 1993 historically, on the UKCS, 85% of discharges have been less than 40 mg/l and 65% less than 30 mg/l *(Binks,1994)*.

Furthermore, It is recognised that produced water effluents contain a wide spectrum of substances other than hydrocarbons, such as ***heavy metals*** and ***chemicals*** used in the recovery / processing operations. With the tighter controls on operation in North Sea, particularly those arising from UK implementation of Paris Commission (PARCOM) requirements, considerable effort will have to be given to improved treatment prior to discharge or the development of other disposal routes such as re-injection into the reservoir. Serious attention is now being given to controlling the range and qualities of such chemicals, particularly. New PARCOM recommendations require a more thorough classification scheme, with agreed, and more extensive tests of toxicity, bioaccumulation and biodegradation potential.

6) Spillage of Oil and Contingency Plans

Under the *Prevention of Oil Pollution Act 1971 (POPA 71), Section 3,* it is an against the Act for there to be a spill of crude oil, fuel oil, lubricating oil and heavy diesel oil from a pipeline or as a result of the exploration or exploitation of the sea bed and the subsoil. This prohibition was extended to all oils when the 1971 Act was amended in 1984. Before any drilling can take place the operator must draw up an Oil Spill Contingency Plan (OSCP) to deal with any escape of hydrocarbons from the installation. This was required under Regulation 4 of the Offshore Installations (Prevention of Fire and Explosion and Emergency Response) Regulations 1995. For operation within 25 miles of the coast or in environmentally sensitive areas, operators must submit special OSCP, for each well, to the DTI who assess them, again with advice from the MPCU and other government organisations. In the UK the responsibility for response to spillage at sea was given to the ***DTI*** and within that Division to the ***Marine Survey Service***.

The *Continental Shelf Operations Notice (CSON) No.7* gives guidance on the authorities to be contacted in the events of particular spills, and the information to be supplied in this context. Advice is also given on the use of dispersants to tackle oil spills. The use of dispersants at sea is controlled by the *Food and Environmental Protection Act 1985, Part II,* and the *Deposits in the Sea (Exemption) Order 1985, Paragraph 21.* Responsibility for response to pollution on beaches in the UK fell to ***local government authorities*** with the need for contingency planning being recognised by, and with guidance notes being issued by, The **Department of Environment, Transport and the Regions (DETR)**. Methods for dealing with oil on beaches were again investigated by Warren Spring Laboratory, DTI, but the funding for this aspect of the work came from DETR. All spills of oil from installations must be reported to the **DTI**. Since 1986, the **MPCU** of the **DETR** has, carried out surveillance flights over the North Sea to observe any oil spills from ships and offshore installations fitted with infra-red and ultra - violet detectors and side-looking radar (*DTI, 1994*). Resources for dealing with an oil spill are available from UKOOA, specialist companies and MPCU.

7) Drainage Water

The Merchant Shipping (Prevent of Oil Pollution) Regulation 1983 (as amended) gives directions on the prevention of oil pollution from offshore installations. Regulation 30 implemented Annex 1 of the MARPOL 73/78 Convention, and sets requirements that are to be met by offshore installations to deal with oil discharge. Offshore installations must comply with Regulation 30, though, and compliance is not routinely monitored and exemptions may be granted by the Secretary of State. Regulation 30(1)(a) mentioned that all operations involving oil discharges should be recorded. From Regulation 30(3)(b) only cover discharges of *drainage water*, when speaking of the discharge of oil or oily mixtures, of which must not constitute more than ***15 ppm*** (1993 amendment) of the discharge.

8) Ballast Water

Under MARPOL rules, permitted discharges of oil and oily mixtures from oil tankers can be made only from a vessel which is outside a Special Area, proceeding en route, and more than 50 nautical miles from land. In July 1993 the previous permitted instantaneous discharge rate was halved to no more than 30 litres of oil per nautical mile travelled by the ship *(HMSO,1994)*. Tankers are also required to operate an oil discharge monitoring and control system and a slop tank. Acceptable results require good operation, proper maintenance of equipment and adequate surveillance. MARPOL requires that all oil tankers of 150 GRT and above, and all other ships of 400 GRT and above, must keep an Oil Record Book for machinery space operations. UK regulations apply this requirement to all UK registered oil tankers and to all UK registered ships over 80 GRT. Tankers must also keep an Oil Record Book for cargo and ballast operations. Entries must be made for each oil-related transfer (*HMSO, 1994*).

9) Dumping

Dumping from marine structures without a licence is prohibited. *Paris Convention 1992, Article 3,* prohibits dumping from offshore installations excepting operational discharges and emissions. There is also a regulatory requirement for any operator to make every reasonable effort to recover debris that is dropped incidentally and to clean the sea-bed within 70 m of abandoned well heads (*Somerville, unknown year*). This convention is not yet in force, but when it does become legislation it will replace the Oslo / Paris Conventions adopting the views from the North Sea Conference. The convention is unique in that it requires the monitoring of the marine environment, stating what should be monitored and why.

10) Litter / Garbage

Intentional discharges of litter form vessels servicing offshore installations and from the installations themselves, are prohibited by legislation. Usually litter / garbage from offshore installations is sent ashore for disposal (*UKOOA, 1986*). The North Sea and the English Channel became a MARPOL Special Area for garbage disposal purposes in February 1991. The categories of garbage and the MARPOL rules which apply to their disposal inside and outside Special Areas are:

(1) *Plastic :* this may not be discharged into the sea in any circumstances;

(2) *Dunnage or Packing* which floats: this can be discharged only 12 nautical miles or more from land, material both inside and outside a Special Area;

(3) *Food Wastes* in particles over 25 mm or less : these can be discharged only 3 nautical miles or more from land or 12 nautical miles from land inside a Special Area;

(4) all other garbage, including paper, rags, glass, metal, bottles and crockery, in particles over 25 mm: these can be discharged only when 12 nautical miles or more from land and outside a Special Area; and

(5) all other garbage, including paper, rags, glass, metal, bottles and crockery, in particles of 25 mm or less: these can be discharged only when 3 nautical miles or more from land and outside a Special Area

(HMSO,1994).

Enforcement of the rules on garbage

Port State Control inspectors may, if they have good reason to do so, check whether ships' personnel are aware of IMO guidelines on minimising and storing garbage, of the limits on discharging and of the Special Areas where tighter criteria apply. They look for practical evidence of beaches such as mixing plastics with other garbage and a lack of garbage on vessels arriving from Special Areas (*HMSO, 1994*). Regulation 4 of Annex V of MARPOL 73/78 is concerned with the discharge of garbage, and special requirements for garbage disposal. The regulation prohibits fixed or floating platforms and from other ships to dispose of any materials regulated by this Annex when alongside or within 500 m of such platforms. Food wastes may be permitted to be disposed into the sea if the platforms are located more than 12 nautical miles from land and other ships when alongside or within 500 m of such platforms and the comminuted or ground food waste no greater than 25 mm.

In enforcing the rules, Governments are encouraged not to rely entirely on penalties, but to consider also a range of other approaches, such as the removal of disincentives, which may be more effective in increasing the use of shore-based facilities. Since the control of garbage disposal is largely a matter of "good housekeeping", programmes of education are particularly relevant. When the *Merchant Shipping (Prevention of Pollution by Garbage) Regulation 1988* came into force with in the UK the *DETR* launched a Champaign with the slogan *Over the side is over!* with some graphic photographs of the effects of illegal discharges (*HMSO, 1994*). The Act 1988 prohibits the dumping of all plastics within UK waters . For dumping of dunnage, lining and packaging are prohibited within 25 miles of land. Food wastes, paper goods, rags, glass and so on may be disposed of in their normal state 12 miles from land and if ground or comminuted 3 miles from land. For vessels or installations related to oil and gas exploration, appraisal or production activities the act prohibits the discharge of all garbage, excluding food waste.

11) Sewage Discharge

Annex IV in the International Convention for the Prevention of Pollution from Ships, 1973 as amended by the Protocol of 1978 (MARPOL 73/78) is concerned with the discharge of sewage from vessels operating at sea. Ships are not permitted to discharge sewage within 4 miles of the nearest land unless they have in operation an approved treatment plant. Sewage must be comminuted and disinfected before discharge between 4-12 miles from land. However, this regulation is not yet in force, and no UK legislation exists to implement Annex IV.

12) Disposal of Solid Waste

Under the Food and Environmental Protection Act 1985 *(FEAPA 85)* It is an against the Law for substances or articles to be dumped in UK territorial waters, or outside these waters if dumped from a British ship or marine structure, without a licence from the appropriate fisheries department. The provisions of the FEAPA 85 relating to pipeline operations were subsumed under Section 45(3) of the PSPA 75 for the laying of submarine pipelines *(ADB,1993)*. However, conditions in the authorisations issued under the PSPA 75 for pipelines, consents under the *Coast Protection Act 1949* for drilling structures/vessels, and the licences issued under the *Offshore Petroleum Development (Scotland) Act 1975* all contain some reference to control or elimination of debris. CONSOP 8 draws attention to some of the problems created by debris and recommends that all waste materials are disposed of ashore (*Read, 1992).* Nevertheless, conditions in the authorisations issued under the PAPA 75 for pipelines, for drilling structures/vessels are approved under the Coast Protection Act 1949, and the licences issued under the offshore Petroleum Development (Scotland) Act 1975, all contain some reference to control or elimination of debris.

13) Discharges Associated with the Commissioning of Pipelines

No person may construct or use a pipeline, as defined by ***Section 33(1) of the Petroleum and Submarine Pipeline Act 1975,*** in or under controlled waters-being UK territorial waters designated under the ***Continental Shelf (Designation of Areas) Order 1964-1982*** unless he is authorised to do so in writing by the ***Secretary of State.*** All pipelines laid in the surf zone and areas of strong currents are buried, and this is usually required for water depths of 100 feet or less. In coastal or deeper waters pipelines must be protected by trenches or other means acceptable to the ***Fishing Industry and Pipelines Inspectorate*** if the pipelines are considered to be at risk. The UK Government adopted some years ago, after the conduct of certain experiments involving the interaction between fishing gear and pipelines, a policy approach which decreed that, whereas all pipelines of 16" (0.4 m) in diameter or less should be buried or trenched, those of larger sizes could safety be laid proud on the seabed and the fishing industry has had to accept this approach to pipeline projects ever since, although it was not invited to take part in the dialogue leading to the adoption of this particular policy *(Buchan et al, 1992).*

Installed Condition on Seabed

It is the normal requirement of the *Pipelines Inspectorate of DTI* that all pipelines should be trenched and buried, however, due consideration will be given to applications not to trench a pipelined that the pipeline is at least 16" in diameter. It can be demonstrated that the pipeline has sufficient stability. It can be demonstrated that the pipeline and its weight coating will not be damaged by trawl board impact. Representative fisherman's organisations have been advised of the proposals and their observations have been accommodated to the extent practicable.

Pipeline Discharges

Prior to commissioning pipelines it is often necessary to fill the line with water containing small amounts of biocide and anti-corrosion chemicals. Specific permission is required before such fluids can be discharged to the sea. Such permits are given, subject to conditions imposed following consultations with DTI and *MAFF / DAFS.* This procedure enables guidance to be given on the acceptability or otherwise of chemicals that might be used in such operations. Under Regulation 5, if any damage or defect occurs in the pipeline or anything escapes from it or there is an emission of ionising radiation or radioactive or other toxic substances from it which may endanger the health or safety of persons, the owner must make an immediate report of the incident to the executive within 5 days of the incident.

14) Atmospheric Emissions Regulatory

Flaring : The *Petroleum Production Licence, Clause12(3)(a),* states that the licensee may not flare gas from the licensed area, except with the consent of the Secretary of State. Consents are given to ensure there is no technical and / or economically feasible alternative means of *disposal.* Every installation operates under a consent granted by the ***DTI*** to flare up to a maximum amount of gas over an agreed time period and the amounts of gas flared must be reported to the DTI. The consent is based on an estimated and reasonable amount of gas to be flared to control production, the amounts used for purging, the number of planned shutdowns (if any) and an estimated number of unplanned shutdowns. These consent are under the Energy Act 1974 and Petroleum (Production) Regulations 1982 (as amended).

Venting : consent is required, unless included within the flaring consent under the same regulation as flaring. ***Halocarbons (halons, CFCs) :*** The EEC Directives require member Governments to introduce legislation to control atmospheric emissions and signatories to the UN Protocols and Conventions agreed to develop methodologies to determine the size of emissions and compile inventories of emission sources. These requirement result from the Montreal Protocol of 1987, which was concern for the ozone layer by setting the aimed to reduce production of CFCs and halons down to 15% by 1997. The UKOOA, whose membership comprises all the companies producing oil and gas in the UK Continental Shelf (UKCS) area, has conducted a study in collaboration with the International Association of Drilling Contractors (IADC) to determine atmospheric emissions resulting from oil and gas exploration and production (E& P) activities.

The International Maritime Organisation (IMO) has implemented the Montreal Protocol, by banning the use of halon on new installations since 1 July 1992. CFCs and halons, are usually used for firefighting offshore. In UK production was prohibited in 1996 by Environmental Protection (Controls on Substances that Deplete the Ozone Layer) Regulations 1996. There are phase out requirements for consumption. Exemptions exist for only 'essential use'. *(ERT, 1997)* ***Noise / Vibration :*** All items capable of producing noise injurious or harmful to health must be suitably insulated required by Offshore Installations and Wells (Design and Construction etc.) Regulations 1996. DETR guidance exposure limits are established for work and accommodation areas on offshore installations.

15) Decommissioning of installations

After 30 years of activity in the North Sea the offshore oil and gas industry UK is entering the final phase for many of the structures and fields decommissioning and abandonment. The UK and Norway Governments attempt to set controls and standards on the actual extent and methods of decommissioning. In the early phases of North Sea developments it was generally perceived that all structures would be removed, as was specified in of the Geneva Convention on the Continental Shelf 1958, Article 5(5) (*Johnston, 1994*). In the last few years there has been much debate about the fate of platforms in the North Sea once the oil fields are depleted. However, in the tenth session of the UN Conference on the Law of the Sea III, a UK proposal resulted in the insertion of key final text (Article 60 (3) in 1982, which states that 'any installation or structures which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the competent international organisation' (*Johnston,1994*). The terms 'installation' and 'structures' in this Article are not defined but are generally held not to apply to pipelines (*Side ,1992*). It is likely that coastal states will develop their own rules for the abandonment of pipelines.

Other conventions influence abandonment policy such as the OSLO Convention in 1972 regarding dumping of decommissioned structures or parts there of with guidelines produced by the OSLO Commission in 1991. In principle the Oslo Convention requires that ' ... *bulky wastes which may present a serious obstacle to fishing and navigation ' should be dumped in water depths greater than 2000 m and at a distance not less than 150 nautical miles from the nearest land (Side, 1992).* Similarly, the London Convention on the 'Prevention of marine pollution by dumping of wastes and other matter' 1972 includes provisions which apply to platform abandonment. The new OSPARCOM Convention 1992 defines Articles (5, 6, 7 and 9) directly applicable to the abandonment of offshore structures.

These international conventions translate to UK Law, particularly through such Acts as the, *Coast Protection Act 1949, Petroleum Act 1987, Food and Environmental Protection Act 1985* (after *Dumping at Sea Act 1974)* and for onshore considerations and *Environmental Protection Act 1990.* Under the *Petroleum Act 1987, Section 11,* in the UK, DTI has made clear to the industry that operators are required to submit abandonment programmes to the Secretary of State for his consideration. Such programmes will be required to comply with the Guidelines and Standards for the 'Abandonment of Disused Offshore Installations and Structures', developed in the IMO and approved by their Assembly in October 1989. The Guidelines require a ***'case by case'*** approach to determine such special circumstances where the coastal state may decide to allow an offshore installation, or structure or part thereof to remain on the seabed. The standard require is shown in Table 7-2.

Table 7-2 UK Standards Requirement for Abandonment of Disused Offshore Installations and Structures *(Taylor,1989 and Side,1992).*

Water Depth >75 m (Platform Weight* >4000 tonnes in air)	• *Complete removal of all Installation*
Water Depth >100 m (Platform Weight* >4000 tonnes in air)	• *Complete removal of all Installation if emplaced* on or after 1 January 1989 *(Note : * Excluding deck and superstructure)*
Water Depth / Weight Combinations outside the above ranges	• *Wholly or partial removal permitted subject to:* *a) Clearance of at least 55 m above submerged remains (may have to be shipped either ashore or to deep water for disposal but not move under the influence of waves, tides, current, or other foreseeable natural causes so as to result in a hazard to navigation),* *b) Maintenance to prevent structural failure of any remains above sea level*
For all emplacements after 1 January 1998 entire removal must be feasible.	

The practical effect of these guidelines for the North Sea is that Southern Basin platforms will have to be entirely removed while the deeper water platforms in the Central and Northern North Sea could be partially removed at the Government's discretion. *DTI has indicated that if partial removal is allowed in the Northern part of the North Sea, clearance of* ***at least 75 m above the submerged*** *remains will be required.* However, it is only now that *DTI* is drafting procedures. These will consider such aspects as:

- Safety case, in consultation with the HSE,
- Comparative cost-benefit analysis of all potential disposal options,
- Outline of preferred option; if at sea, involving SOAEFD or MAFF who would consider granting of licence under the Food and Environmental Protection Act 1985 *(Johnston, 1994).*

Any disposal of parts on land would be subject to the Environmental Protection Act 1990, particularly duty care. The Petroleum Act 1987 in addition to making provision in respect of the abandonment of offshore installations and submarine pipe-lines and in respect of safety zones around offshore installations , amends the Petroleum (Production) Act, 1934, and also amends the Law relating to pipe-lines. It repeals ss. 34-39 of *the Petroleum and Submarine Pipe-lines Act, 1975,* regulating the construction and extension of refineries.

16) Safety Zones

The 1958 Geneva Convention on the Continental Shelf allows states to create 500 m radius safety zones around fixed platforms and drilling rigs when operating on their shelves and to regulate navigation within these zones. These zones minimise the risk of collisions by other sea users (*Doddy, 1993*). In UK safety zones were introduced around rigs, as specified in the *Mineral Workings & Offshore Installation Act, 1981.* These extend for 500 m around all platforms and are areas from which ships are excluded unless directly involved with the structure. The *Petroleum Act 1987, Section 21*, provides for the automatic establishment of a 500 m safety zone once an installation or part of it, carrying on activities defined in Section 21(2), is being assembled, maintained or dismantled in tidal waters and parts of the sea in or adjacent to the UK up to the seaward limited of the territorial sea and waters designated under Section 1(7) of the *Continental Shelf Act 1964.* Additionally the Secretary of State may by order establish a safety zone extending to a radius of 500 m around the installation in waters outside those encompassed by Section 21.

SUMMARY

Within the UK industry, there is a positive environmental awareness and frequent reviews of the present state of knowledge on the Quantity and effects of offshore operations, are undertaken. The present state of knowledge suggests that there is no significant environmental impact on the quality of the North Sea, and both individual companies and the industry co-operate with Government on research, to improve understanding of the North Sea environment. There are various sources of discharges to the marine environment from offshore oil & gas activities, but not all of them are subject to legislation nor is the basis necessarily environmental. Environmental regulation of offshore installations on the UK continental shelf is currently through controls placed on the quality and quantity of liquid, gaseous and solid waste streams discharging to sea and atmosphere, or returned to shore. Also emergency procedures are required by the regulation. Discharges containing oil or operations where oil may be discharged to the sea and flaring from production operations (economic), are rigorously controlled, through Acts or Regulations.

Section 8

REVIEW OF A NEW APPROACH FOR ENVIRONMENTAL MANAGEMENT WHICH AFFECT OIL & GAS INDUSTRY IN THE NETHERLANDS AND USA

8.1 Introduction

This study investigates a new environmental management approach, **'Environmental Voluntary Agreement - Environmental Covenants'** related to oil and gas industry, which has been used only in the Netherlands. This new approach was first introduced by the Dutch in 1992 and its use started in the oil & gas industry sector in 1995. It is excepted that the environmental covenants approach is more flexible than the traditional approach by both Government and Industries sectors.

This research also investigates scope on '**Effluent limitations final guidelines,** representing the degree of effluent reduction attainable by the application of the 'Best Available Technology Economically Achievable (BAT)' and by the application of the 'Best Conventional Pollutant Control Technology (BCT)', and **new sources performance standards**; *Standards of Performance for New Sources (NSPS),* limiting the discharge of pollutants to water of the United States from the offshore subcategory of the oil and gas extracting point source category. This rule is promulgated under authority granted to the Environmental Protection Agency (EPA) by the Clean Water Act. This research also reviews a new strategy for protecting the US environment, **Voluntary Partners for the Environment,** which has been introduced in the US over the last several years by the EPA. At present, the **'Natural Gas Star'** Programme is related to natural gas industry, which has the main target *to reduce methane emissions* from the natural gas industry.

Most of the information in the section source has came from meeting & interviewing the Netherlands project group level II (E&P Industry Covenant) Authorities, and the Netherlands Oil & Gas Exploitation Association (NOGEPA) on 24-25 July 1997 in Amsterdam as below.

1. State Supervision of Mines,

    Dr.Leo Henriquez, Chief Inspector / Environmental Advisor,

2. Directorate-General for Environmental Protection,

    Mr. Kees Meijer, Senior Officer,

3. Directorate-General for Public Works and Water Management North Sea Directorate,

    Mr. Ronald van den Heuvel, Project manager Sea-use Management,

4. Ministry of Economic Affairs,

    Dr. Jelle W. Nijdam, Senior Officer,

5. NOGEPA,

    Dr. W.J. van Der Have, Deputy Secretary General

The USA information in this section is also sourced from meeting & interviewing the government authorities of State of Alaska and oil company on 13-23 June 1997, at State of Alaska, Anchorage, as below, which was organised by Mrs. Alice Bullington, UNOCAL Alaska Ltd., and Mr.Tawatchai Siriphatarachai, UNOCAL Thailand Ltd., :

1) Department of Environmental Conservation,

1. ***Mr. Le Beau J P,*** Environment Specialist, Compliance Assistance Office Hazardous Waste Co-ordinator,
2. ***Mr. Bohn PA K,*** Supervisor, AQ Operating Permits, Air Quality Maintenance Section,
3. ***Mr. Dolan R.,*** Environmental Engineer,

2) Office of the Governor - **Mr. Birnbaum M,** Project Review Co-ordinator,

3) Joint Pipeline Office - **Mrs. Molly B.,** Ex-Project Review Co-ordinator,

4) UNOCAL Alaska Ltd. - **:**

1. ***Mr. Donohue J T,*** Vice President,
2. ***Mr. Beitia J T,*** Manager,
3. ***Mrs. Alice Bullington,*** Senior Environmental Scientist,
4. ***Miss Hammond L L,*** Advising Environmental Engineer,
5. ***Mrs. Sullivan F W,*** Senior Environmental Scientist,
6. ***Mr. Pierre B. St.,*** ex-Senior Environmental Scientist,
7. ***Mr. Giles T,*** Facility Foreman of Monopod Platform ,
8. ***Mr. Smith G.,*** Field Operation No.1,
9. ***Mr. Williams B.,*** Drilling Mud Engineer of Monopod Platform,

8.2 THE NETHERLANDS

The Dutch sector is the third most important in the North Sea, ranking after the UK and Norway in terms of the level of offshore activity and expenditure. The Netherlands was the first country to produce hydrocarbons (gas) from the North Sea and still has a very active offshore industry (*Mackay,1992).* However, in the 1970s and early 1980s the Netherlands adopted a policy of 'no exports' in order to conserve the indigenous reserves. The regulations with regard to the environment are, inter alias, rules aiming at the prevention of disturbances of marine environment as a consequence of the construction of pipelines and the prevention of pollution of the North Sea coming from oil & gas operation.

8.2.1 Oil and Gas Activities

During 1996, following a period of very low exploration activity and reduced levels of capital expenditure, exploration and appraisal activity on the Netherlands continental shelf has increased significantly. As of January 1996, 54 wells (18 exploration wells, 6 appraisal wells, and 30 production wells) were drilled (that is 18 wells more than in 1994) *(MEA,1997).* There are about 300 gas fields, of which 140 are under the territory and 160 under the Netherlands part of the North Sea. Currently gas has been produced from 150 fields, about half will be brought into production in the next 10 to 15 years. The yearly gas production from the small fields is about 40 million cubic metres. Oil production in the Netherlands is about 55,000 barrels per day (3.2 million cubic metres per year) *(State Supervision of Mines,1996).*

As of 1st January 1996, the volume of total remaining proven Dutch gas reserves is 1,815 milliard m^3 (st) and remaining expected reserves is about 1952 milliard m^3 (st). Oil reserves as remaining proven reserves are about 14 milliard m^3 (st) and as remaining expected reserves are about 50 milliard m^3 (st) *(MEA,1997).*

8.2.2 Legal Framework

The Mining Act 1810 and amendments governs all exploitation and production of mineral resources. This legislation is applicable for both onshore and the territorial waters. In 1996 the Mining Acts for the Netherlands Territory and the continental shelf, were modified in accordance with European Directives concerning the exploitation and production of minerals. All Mining acts will be integrated into one. NOGEPA also wishes to be actively engaged in discussions with Authorities on the formulation and development of the actual text for this new legislation. However, the Industry' s ability to influence improvements that could minimise the introduction of new regulations and enhance the existing mining climate have been limited at best *(NOGEPA,1997(2)).* This lack of constructive and co-operative dialogue between Industry and the Authorities is a real concern to NOGEPA.

Petroleum Exploitation and Production activities is fulfilled by the State Supervision of Mines, a Division of the Ministry of Economic Affairs. This authority has four core tasks as 1) supervision of exploitation and production of minerals, 2) advising the Minister of Economic Affairs, 3) issuing permits and exemptions, 4) investing infringements of the law. These tasks are focused on safety, health, environment and the efficient production of minerals. State Supervision of Mines has developed specific working arrangements for its inspection regime, which are based on a systems approach, as recommended by Lord Cullen, in his report of public inquiry into the Piper Alpha disaster in the UK of the North Sea in 1988. These supervisory arrangements are based on three guiding principles namely proactive, preventive, and reactive.

Enforcement policy : the State Supervision of Mines uses the three phase model to investigate non-compliance issues, and uses two phase model for serious non-compliance issues or repeated offences (see in Fig. 8-1).

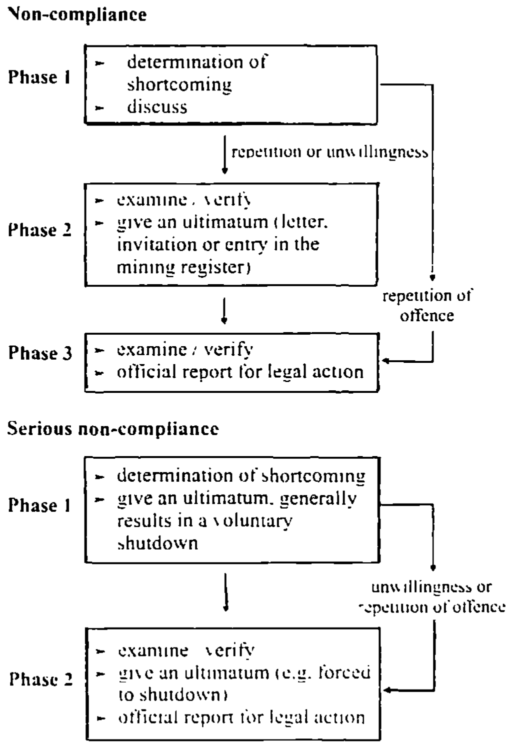


Fig. 8-1 Phases model is used for Enforcement Dutch Policy *(State Supervision of Mines,1996)*

1) Minimum environmental issues requirement for Oil & Gas Activity

Generally, the Netherlands Government attitude towards the minimisation of impacts resulting from offshore operations can be considered to be very forward thinking, often going beyond minimum requirements identified under international agreements. Main environment protection requirement from the government are follows:

- ***oiled cuttings*** - are normally taken to shore and 75% of the oil is recovered by vacuum distillation;

- ***aromatics (PAHs)*** - the Netherlands regards steam stripping (offshore) as best practice, but are investigating the use of air stripping followed by biofiltration (a technique used in contaminated land clean-up in the terrestrial environment);

- **produced water** - a maximum allowable monthly average oil content of 40 ppm may be discharged at sea. However re-injection is regarded as best practice but only where no additives (such as chemicals of any type) are present in the produced water.

- **The use of Oil Base Muds (OBMs)** - OBMs is permitted for use only in very specific circumstances, the opinion of the Netherlands Government being that the use of Water Base Muds (WBMs) is practical in most cases, even in high angle wells in difficult geological formations; and

- ***In the Waddenzee*** - the concept of *'zero discharge'* has been put into practice, with no discharges of any effluent or solids from offshore installations being permitted within the area.

2) Environmental Matter : Environmental Impact Assessment

Following an EU Directive on a requirement for an EIA offshore with entrances for oil and gas production of respectively 500 tonnes per day and / or 500,000 m^3 gas per day lobbying efforts by E &P Forum and with MEA were started to have the threshold for gas production raised by making the limit for condensate production equal to that of oil production. At Present it is expected that the EIA will remain unchanged*(NOGEPA (2),1997),* and if so, it will be considered to have a policy EIA (beleids MER), for which MEA is also in favour.

8.2.3 Dutch Environmental Policy and Long Term Agreements (LTAs)

The environmental Policy of the Dutch government is aimed at controlling both the sources of pollution and its impact. Pollution at source is tackled by measures aimed at target groups to reduce emissions to the environment. The policy based on the use of the 'most effective' and 'best available' technology, and concepts such as 'avoidance of unnecessary pollution' and the 'stand-still principles' *(Wolters, 1994).* See Environmental management approach of the Netherlands in Fig. 8-2

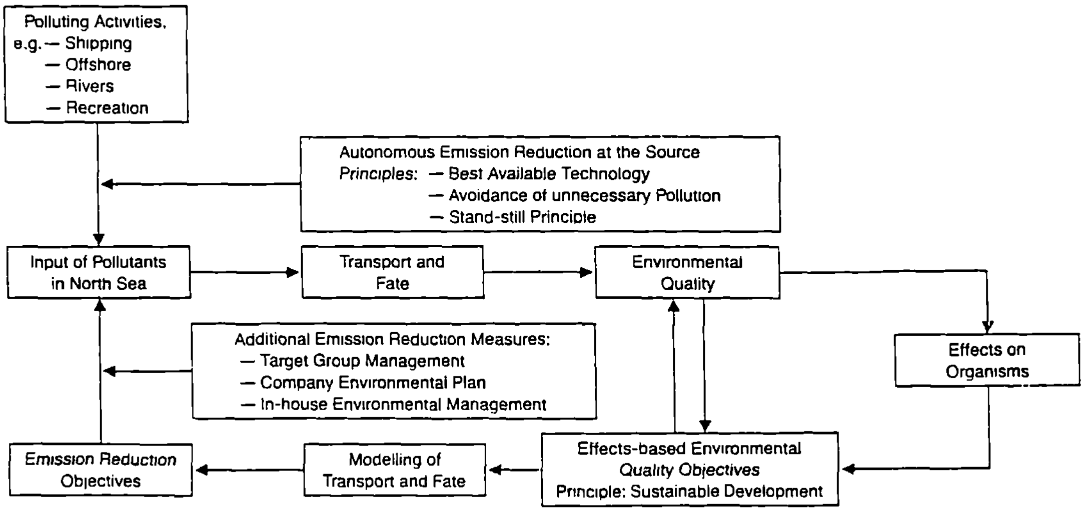


Fig. 1 North Sea Environmental Management: the Dutch Approach.

Fig 8-2 Environmental management approach of the Netherlands *(Wolters, 1994)*

The second policy approach - dealing with the 'impact of pollution' - 'sets general environmental quality objectives (EQOs) (by using the risk approach). Translating EQOs into emission reductions, gives the implications for 'target groups of polluters' (Fig. 8-3).

Fig. 8-3 Conceptual basis for Integrated Environmental Management *(Wolters,1994)*

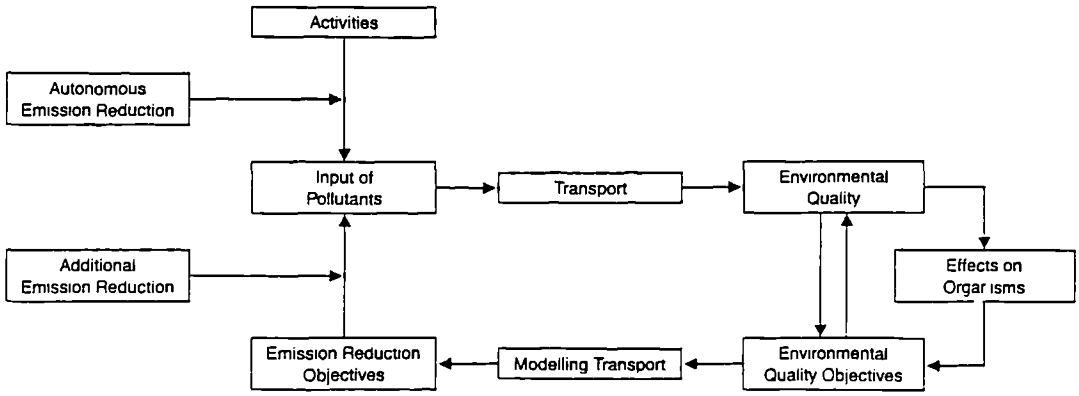


Fig. 2 Conceptual basis for Integrated Environmental Management.

a) Policy Implementation: National Environmental Policy Plan (NEPP)

In 1989, the Netherlands Government published its National Environmental Policy Plan (NEPP), followed a year later by the Policy Plan Plus (NEPP plus). These form a strategy for achieving a 'sustainable environment' within one generation. The entire environmental agenda has been translated into 'quality objectives'. The latter requires consistent policies and wide enough public support, and close co-operation with interest groups.

b) Target Group Management Policy for Industry

The policy begins by defining what is expected from target groups in order to achieve particular environmental objectives. The objectives in the NEPP have been translated into specific emission reduction targets for industry. These, in turn, have been translated into targets for different sectors of industry. From the sector, the process continues to the level of each company. At sector level, the industry and the pollution control authorities sign 'COVENANTS' agreeing an Integrated Environmental Target Plan for that particular sector (Fig. 8-4).

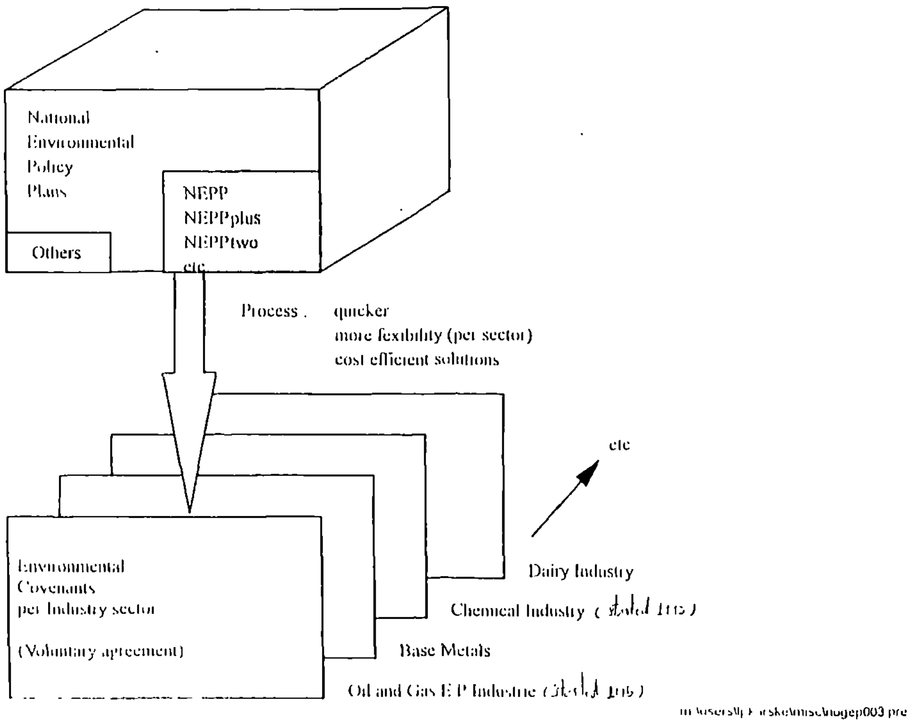


Fig. 8-4 Environmental Covenants per Industry sector in the Netherlands *(NOGEPA, 1997)*

However, without creating the right conditions, the imposition of all kinds of regulations on products will only be counterproductive. This may put a heavy burden on the individual responsibility of all those involved but by following developments if objectives fail in any sector and if the co-operative approach is not successful legislation will be necessary *(Wolters,1994).*

The government, specifically the Ministry of Housing, Physical Planning and the Environment, the Association of the provinces of the Netherlands and the Association of Netherlands Municipal Authorities, has signed declarations of intent with a number of industry sectors on the implementation of environmental policy (see Table 8-1). For the energy issue, the declaration of intent links directly to the LTAs that the Minister of Economic Affairs has contracted with these sectors.

Table 8-1 Sectors that have signed environmental covenants

Sector	Date of Environmental covenant	Long Term Agreement
Base Metals Industry	March 1992	Yes
Graphical Industry	April 1993	No
Chemical Industry	April 1993	Yes
Dairy Industry	July 1994	Yes
Electro metallurgy Industry	December 1994	with sub-branches
Textile and Carpet Industry	March 1996	Yes
Paper Industry	March 1996	Yes

(Ministry of Economic Affairs,1995)

c) Company Environmental Plan

The industry sector have to produce 4-yearly Company Environment Plans which sets out the company's contribution to achieving the Integrated Environmental Target Plan. The plans will initially assume the state of the art, i.e. best available technologies and best environmental practices. In return, the pollution authorities agree to use the Company Environmental Plan as the basis for licensing policy for that company.

8.2.4 Environmental Contracts & Environmental Covenants

Under plan by 2000, certain maximum allowable risk levels for waste releases should not be exceeded, and that these risk levels should be negligible by 2010 *(Herenius et al, 1994).* The plan calls for the following reductions in releases to the environment from 1985 levels: by 2000: 50-70%, by 2010: 80-90%. Due to the public law approach to pollution control, its reduction by using penal and administrative law sanctions, is proving increasingly ineffective *(Dunne' J.V.,1993).* There is a growing awareness, especially in the Netherlands, that there might be another way coming to terms with polluters by concluding ***long-term contracts for the reduction of toxic discharges*** and allow the polluter to adopt the most appropriate techniques and implementation schedules, in order to reach the agreed long-term goals. *(Dunne',1993).*

It was realised that these targets could not be met by solely issuing new legislation, as this is often a lengthy process which does not normally lead to cost effective solutions. It was therefore proposed that legislation be supplemented by ***voluntary agreements*** the so called

"Environmental Covenants"(CV), between government and industry sectors to achieve these reductions *(Heranius et al.,1994).*

1) What is wrong with the traditional approach?

The traditional approaches based on direct regulation *are no longer satisfactory* because environmental issues are changing and getting more complex, solutions are becoming more costly and affect competitiveness, and the 3Es are not well addressed: *Effectiveness*-getting the desired results etc, *Efficiency*-cost and simplicity etc, and *Equity*-fairness etc *(Winsemius,1993).*

2) What are the Environmental Contracts (ECt) and the Environmental Covenants (ECv) ?

Environmental Contract (ECt) and Environmental Covenants (ECv) *are*: ***'documented agreements'*** between national government and a private organisation or group of organisations and are aimed at general targets of environmental policy, or the implementation of that policy *(Hinssen and Gerits,1994).* The ultimate aim of Environmental Covenants is to achieve a sustainable development in a speedy and cost-effective way to "spend your environmental dollar wisely". The environmental covenants can be relaxed and have the character of a ***'gentlemen's agreement'*** *(Peter J.J. van Buuren,1993, Hinssen and Gerits,1994).* They are a *private law*, not public law, i.e. not direct regulations *(Winsemius,1993).* ECt & ECv are somewhere between *'indirect regulation'* and *'self-regulation'* by means of economic instruments *(Winsemius,1993).*

Basically, there are two types of agreements involved: the **Covenant (Cv),** between government and group of companies, and the **Contract (Ct),** between injured party and company/ group/industry. The environmental covenant is a new phenomenon which is now frequently used in the Netherlands where it has grown out of the ***'target group management'*** strategy of the national environmental policy plan *(Hinssen and Gerits,1994).* Thus, target economic sectors should directly involved in the environmental decision making process. It is a direct result of a greater recognition by government of the interdependence of public and private sector. This interdependence between actors is expressed in the term of ***'co-government'*** *(Hinssen and Gerits,1994).* The key issues of

CV consist of a definition of the ***'rules of the game'*** and a part called ***'Integrated Environmental Targets'*** *(IMT) (Heranius et al.,1994).*

3) Types of Environmental Covenants:

There are two types of covenants. The first is used as an alternative to legislation, replacing laws that might otherwise involve excessively complex regulations, and result in problems of implementation and enforcement. The other type is used in addition to legislation, with formal legal requirements remaining to ensure that, should industry participants fail to act as 'gentlemen', compliance can be forced *(Hinssen and Gerits,1994).*

4) Certain Conditions of Covenants

There are four certain conditions of the covenants which are required for effective use of covenants. The first is that the number of participants should be small with the industry dominated by a small number of players. The second is that the government involved must have a mature environmental policy. The third, all participants must be experienced and have mutual respect. The final is a tradition of joint problem solving being an advantage *(Hinssen and Gerits,1994).*

5) Advantages and Disadvantages of Cv and Ct:

The main advantages of a voluntary agreements, Cv&Ct approach, are more efficient to administer and enforce, shifts burden of proof to the company, encourages a pro-active attitude, more flexible than regulation, can increase internalisation of environmental costs, multi-media, can co-ordinate multiple regulatory agencies, offers security of environmental investments *(Adopted from: Peters, 1992).* However, the Cv and Ct are ***new ideas***, and present ***new problems***, e.g. how to enforce?, what sanctions to use, if needed?, how to guarantee third-party liability?, what is the relation to public law (i.e. regulations)?, what is the relation to licences etc?.

So, there is less enthusiastic for covenants as an alternative to legal measures *(Hinssen and Gerits,1994).* The Dutch Advisory Council on Environmental Policy has mixed feelings about covenants. They note:

1. how can covenants be incorporated into the way industry traditionally develops policy,
2. how can they engender trust between the regulator and the regulated, and the importance of the psychological effects on the industry of participating in the development and implementation of environmental policy,
3. how could this be the key to ensuring that the concept of sustainable development is internalised by industry.
4. the extent to which parties are bound by a covenant is a major legal problem.

(Hinssen and Gerits,1994)

Nevertheless, Gilhuis and Houtsma (1994) pointed out that general opinion in recent literature seems to be that covenants can fulfil a useful supplementary role to regulations. While enforcement may be a problem, covenants are not unique in this respect, and procedural guarantees can, if necessary, be built into the covenants. Although when this occurs, the direct regulation diminishes, flexibility is lost *(Hinssen and Gerits,1994).*

6) Cv and Ct will not work well if:

1. the national environmental policy is not mature, and based on mutual respect and understanding between parties
2. the parties are not experienced and credible
3. the negotiators are not respected
4. there is no tradition of consensus-seeking and joint problem-solving
5. the 'target group' lacks suitable market structure:
    - small number of companies dominating the market (i.e. oligopoly)
    - a powerful industry association to represent members
6. the government is not prepared to stand by the partner industry, and not make 'knee-jerk' alterations in commitment to the Cv.

(Adopted from: Winsemius,1993)

7) Cv and Ct are likely to work best where:

1. the target group is heterogeneous (i.e. has major differences in processes, activities, location etc.)
2. no standardised solutions are needed or available
3. the country must make provision for: Cv and Ct to be admissible in law, and defining the freedom of regulatory agencies to make Cv & Ct.

8) Requirements of Cv

1. must offer real advantages to all parties- e.g. meets goals, saves time, money, effort
2. must be comprehensive (all processes)
3. should be multi-media (all environmental media)
4. should offer safeguards to third parties- i.e. make public, to motivate commitment
5. must legally bind all parties- but often difficult to define target groups
6. fairness to foreign competitors
7. the negotiation process must be seen as being as important as the content

9) Stages in Setting up Cv and Ct

1. set long-term pollution reduction objectives
2. select priority branches of industry, e.g. chemicals, food-processing, metals, E&P
3. draw up declaration of intent between government and industry / company.
4. simultaneous to 3.: set up public relations campaign
5. negotiate: need to establish a 'best practice' approach:
6. set agenda
7. assess options
8. development and implement action plan
9. best possible 'process management'
10. do not just settle for a bland 'charter'
11. draw up document with results of all consultations and negotiations. Plans should contain:

12. agreement on measures to be taken
13. agreement on techniques
14. agreement on supporting activities
15. agreement on further research, for better task-setting and decision- making
16. agreement on further consultations required
17. Implement and monitor plans
18. Remain committed to aims, plans, and partners

10) The Covenants As A Management Tool In The Licensing Process

Both instruments are of a different character. Peters (1992) mentioned that the licence is prescribed by public law, is narrowly regulated, and affords all kinds of procedural safe-guards to the parties concerned, included the third parties by law. ***A licence is a one-sided public instrument laid upon the company***, on the other hand the ***Covenant (Voluntary Agreement; Approved Plan), is a two-sided instrument based on private law and the consent of parties***. Third parties have no access to the administrative court in respect of the plan *(Peters J.,1992).* The voluntary Agreement might be such a management tool: an informal tool not meant to replace the licensing process. The intention is to smooth the licensing process *(Peters J.,1992).*

11) Limitations On Use Of Environmental Covenants

From a legal view point, environmental covenants are only of limited value because:

1. they cannot replace or revise conditions of licences,
2. government cannot make promises to not make subsequent changes to regulations or conditions - only to make the *'best effort'* to do not do so, i.e. government cannot be fully bound,
3. they cannot compel performance in the short term - i.e. only work in long term,
4. individual companies cannot usually be directly bound,
5. the dominant position of the public law system of environmental legislation with its unilateral powers for public authorities can hardly be side-stepped by the conclusion of covenants. *(Adopted from: Peter J.J. van Buuren,1993)*

8.2.5 A Covenant with the Dutch E&P Industry

In 1990 a Target Group was formed with the aim of developing an ***integrated environmental strategy*** for the Dutch E&P industry. One year later the Ministry of Economic Affairs, the lead government department for oil & gas activities, started drafting an environmental action plan for these activities. However, all work stopped in the second half of 1992 when the government accepted a suggestion by the Netherlands Oil and Gas Exploitation Association (NOGEPA) to develop a '***covenant***' instead *(Hinssen and Gerits,1994).*

In August 1992, the E&P industry started discussions with the government about an ***Environmental Covenant*** *(Heranius et al.,1994).* It was recognised that regulations alone could not meet these targets, and it was proposed that legislation be supported by ***'voluntary covenants'.*** Work on the covenant took another two years and was completed in 1994. The Dutch covenant with the oil & gas producing industry came before parliament later in the same year. A 'declaration of intent' was signed in September 1994, between the Dutch E&P industry body, NOGEPA, (as 'target group') and relevant regulatory authorities, following discussions which had been held since 1992. This declaration is a legal contract under civil law. NOGEPA saw the covenant as an opportunity to make an agreement on targets set further ahead from years 2000 to 2010 than would have been possible with the four year action plan (1992-1996 or 1993-1997) *(Hinssen and Gerits,1994).* Since 2nd June 1995, the offshore industry in the Netherlands is regulated by means of a covenant between the Minister of Economic Affairs (MEA), the Minister of Transport, Public Works and Water Management (RWS - Duirectoraat-General Rijkswaterstaat Directie Noordzee), and the Minister of Housing, Physical Planning & the Environment (VROM - Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer), and also by Chairman of NOGEPA.

The covenants provide the industry with environmental commitments and targets to be achieved by 2000 and 2010. Under the covenants each oil & gas company has agreed to prepare a company environmental plan (CEP), in which environmental performance is measured during a series of four year periods, the first being 1995-1998 inclusive and using 1990 as the baseline year indicating current emission levels, changes in emission levels over the coming four years, and forecasts to

2002. During the first half of 1996 all participants in the Environmental Covenant prepared their draft Company Environmental Plans (CEPs), based on all these CEPs plans the NOGEPA aggregated Industry Environmental Plan (IEP) was prepared. The offshore parts of all plans were submitted to the Ministry of Economic Affairs (MEA), State Supervision of Mines by June 1996, for one month's public viewing in the various provincial house. The onshore parts of the CEPs of operators involved were submitted to the Authorities by 1 July 1996. The final CEPs were submitted to the Authorities on 1 November 1996. The IEP was finalised and submitted in early December 1996. The final CEPs and IEP were approved by the Authorities (MEA / VROM / RWS). Annual reports will be required as a condition in the covenant on progress of implementation of measure, and the results thereof. First annual reports were required by 1 June 1997, covering the years 1995, 1996, with an expectation for 1997, also elucidating on differences, if any, with the emission profiles given in the CEPs and IEP. The environmental targets which form the basis of the covenants stem from the Netherlands Integrated Environmental Target Plan (IETP), as applied to the oil and gas sector (see in Fig. 8-5).

8.2.5.1 Standard Set in E&P Industry Covenants

The standards set in the Government / Industry covenant are summered in Table 8-2

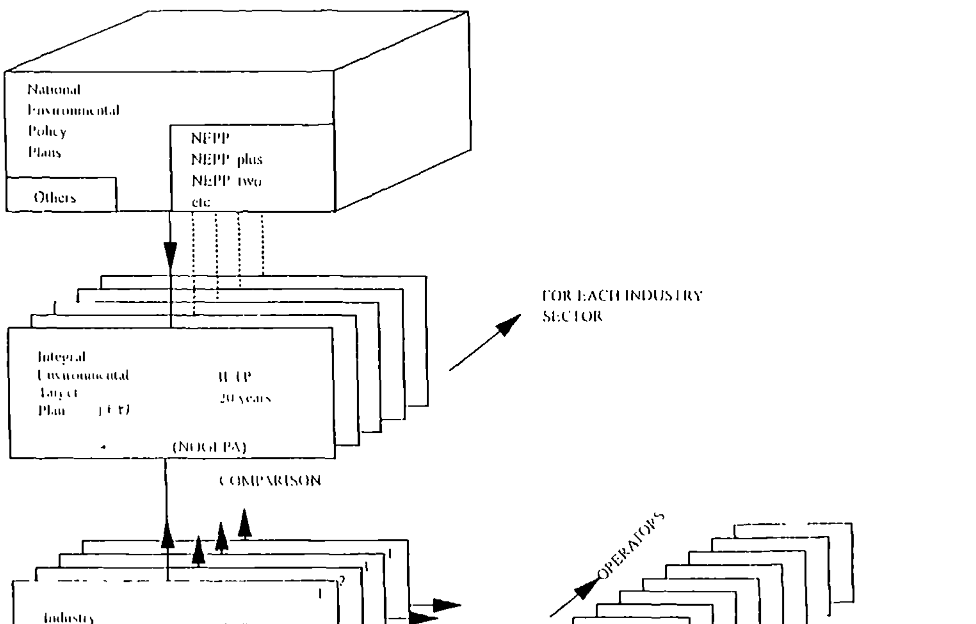


Fig. 8-5 Interrelation between IETP, CEPs and IEP *(NOGEPA,1995)*

Table 8-2 Environmental targets set under the Netherlands Government Offshore Industry Covenant *(Source: Berry, 1997)*

Criterion	Target
Climate Change - CFCs, HCFCs and Halons	• Reduction of CFC use to 1986 levels by 1995 • Progressive removal of halon using equipment • Reduction of HCFC use • Discontinuation of all 1,1,1-trichloroethane use by 1996
Climate Change - CO_2 and Methane Emissions	• 20% increase on 1990 levels in energy efficiency by 2000 (with corresponding CO_2 reductions) • 10% reduction in methane emissions by 2000 (based on 1990 levels) [*NOGEPA believes a 40% reduction is possible with increased methane leakage control and reduced venting*]
Acidification - SO_2 and NO_x Emissions	• 80% reduction of SO_2 emissions (on 1990 levels) by 2000, 90% by 2010 • 55% reduction on NO_x emissions (on 1990 levels) by 2000, 90% by 2010 [*note the oil and gas industry believes that a reduction in levels of NO_x production by only 10-20% by 2000 and 40-50% by 2010 are possible through the implementation of existing technology*]
Acidification - VOC emissions	55% reduction by 2000, 80% by 2010 based on 1990 levels of 23.5 kton [*note the oil and gas industry only believes that less than a 55% reduction is possible. It further believes the 1990 base level to be set too low, making reductions more easy*]
Heavy metals & Benzene in Produced Water	• Offshore discharges in the Dutch sector represent the following percentage of national discharges: mercury 8.3% cadmium 1.8% lead 9.6% zinc 18.5% nickel 2.5% benzene 68% • National reduction targets have been set by the Dutch Government: (2000 / 2010) mercury 70% 90% cadmium 70% 90% lead 70% 90% zinc 50% 80% nickel 50% 80% benzene 60% 60% [*However, the offshore industry points out that efficient removal of heavy metals from produced water is currently impossible, produced water composition and volume varies from field to field (so therefore should treatment levels and types) and that many Dutch gas/condensate platforms discharge very low volumes of produced water. Consequently, the Dutch industry association NOGEPA cannot sign up to any reduction targets, but will carry out a new study on emission reducing measures.*]

Table 8-2 Environmental targets set under the Netherlands Government Offshore Industry Covenant *(continued)*

Oil discharges	• Avoidance of oil discharges as far as possible. The industry will meet the 40mg/l aliphatic oil in water content for discharges offshore. Discharges of drilling cuttings containing oil were banned in 1993.
Radioactivity	• The national target to be achieved by 2000 is based on the concept of ALARA, as low as reasonably achievable.
Organo-halogens	• The national (and international) target is the reduction and elimination of discharges. The industry has agreed to come forward with reduction targets in line with international agreements.
PAHs	• In line with PARCOM decisions and International Ministerial Meetings, the discharge of PAHs and potential measures to reduce such discharges are being investigated. • The industry has agreed to come forward with an analysis of sources of PAHs (produced water, flaring, testing etc.) and set reduction targets in line with international agreements.
Added Chemicals	• Discharges should be reduced and the industry will use the CHARM model as a basis for their reduction.
Offshore Waste Flows	• The national target is for a reduction of 40% of all waste dumped or incinerated by 2000 (compared to 1990 levels). • WBMs are recycled, the non-recyclable parts and associated cuttings being dumped at sea. OBMs are also recycled, the non-recyclable parts incinerated, and the associated cuttings brought to shore. Oil will be removed from these cuttings prior to landfill or use as hard-core.
Drilling Muds	Targets accepted by NOGEPA for management of mud and cuttings.

Muds			
WBMs	1990	2000	2010
kms drilled	152	65	53
total use (tonnes)	152,000	70,000	54,000
to be recycled	133,000	65,000	50,000
to be discharged	104,000	50,000	34,000
OBMs			
kms drilled	13	3	3
total use	6,650	1,800	1,800
to be recycled	3,500	1,150	1,150
to be burned	1,700	700	700
to be discharged	17	0	0
Other muds			
kms drilled	0	10	10
total use	0	5,600	5,600
to be recycled	0	5,300	5,300
to be discharged	0	1,400	1,400
(if discharge is unacceptable, OBM will be used)			
Cuttings			
Water-based			
produced	59,000	28,000	24,000
to be discharged	28,000	28,000	24,000
Oil-based			
produced	3,250	1,000	1,000
to be dumped at sea	752	0	0
recycled oil	2,500	1,000	1,000
to be dumped on land	2,200	880	880

8.2.5.2 What the Covenant Does not cover in E&P waste

The E&P covenant is structured around an Integral Environmental Target Plan (IETP) and individual Company Environmental Plans (CEP). The IETP gives targets for the entire industry. Targets have been set for air pollution and produced water discharges in the year 2000 and 2010 based on 1990 emissions. Surprisingly, the targets do not carry the force of law, the only obligation the industry in under, is to develop CEPs, make some effort to reach targets, and report on progress annually. However, the Ministry can sharpen the policy for the company within the limits of the operating permits required by each installation if the CEP or the progress report does not comply with the targets. The current covenant is noteworthy for what it fails to deal with. There are some of the neglected issues which were not included in the action plan, such as *(Hinssen and Gerits,1994)*

- the cleaning of seabed contaminated with oily drill cuttings; the covenant does not cover targets for water base muds and Drilling Mud Discharges, because it has a impact only within 50 m and can recover within 3 months *(source: by interviewed (25 July 1997) Mr. Kees Meijer, Environment Department).* However, NOGEPA is doing research about the impacts of drilling cuttings (*source : by interviewed (24 July 1997)* Deputy Secretary General, NOGEPA, *Dr. W.J. van Der Have).*
- the testing and maintenance of pipelines;
- seismic exploration at sea;
- the need for special regimes in sensitive areas, including the closure of certain areas;the removal of installations after the exploitation phase;
- the need to close old wells when the level of oil in produced water rises above an acceptable level; and
- the reinjection of produced water into its original sub-seabed geological formations. Target - if the concentrate has no effect or no risk to the environment, there should be then no need to required a 'zero-target' *(source : by interviewed (25 July 1997) Mr. Kees Meijer, Environment Department).*

8.2.5.3 Some opinions of the authorities working group and NOGEPA

This information was source from interviews with the Netherlands project group level II (E&P Industry Covenant) Authorities, and the Netherlands Oil & Gas Exploitation Association (NOGEPA) on 24-25 July 1997 in Amsterdam.

a) What are the goods points and weak points of the covenants?

Good points of covenants are that they are more flexible than regulation they can be negotiated between the regulator and the regulated. The regulations do not cover everything. Amounts of emission can be bought or sold between companies to reach the target of reducing pollution in covenant, in the case a company having to run an operation, high cost of equipment.

However, the covenant also has some weak points such as some targets are unfeasible on technical or economic grounds for this situation, even with reasonable environmental effort. Both government and industry sector are still do more research, but it will take time and money. The second weak point is the ammount of paperwork which takes quite long time (at least 7 months to approval, by three Ministries, for the first draft of the Environmental Plan). The another point is the targets can not be changed. The other problem of the covenants is the 'legal status', the covenants is an agreement based upon private law, so there can be some difficulties with regards to the enforcement of measures. That' s why the Netherlands regards the covenants not as a substitute for law and legislation, but as complementary to it' (*Heuvel,1997*).

b) Are the Dutch Covenants with the oil & gas industry successes?

The Government authorities view point is that it is too early (started in 1995, and it is only in phase 1) to know the result or to say that the covenant is a success, although chemical covenants, which were started in 1993, seem to work. However, the government authorities believe that the E & P covenant is more flexible than regulation, and should be a success in the long run. From the NOGEPA view point the covenant is a success because it can be negotiated with the government, and is more flexible than regulation. There are other opinions that, in several crucial respects the

Dutch covenant with the oil & gas industry is ***inadequate*** *(Hinssen and Gerits,1994).* According to then the main problems of the covenants are as follows :

- The agreements in the covenant lack binding legal power. *First,* all most covenant obligations do is oblige industry to act, to make an effort. The industry is not obliged to achieve any particular result and there are no targets that must be met. *Second,* where existing legal regulations are insufficient, the Ministry of Economic Affairs will have limited opportunity to sharpen individual permits for those companies and /or installations that do not meet their goals. As long as this legal deficit continues the covenant will remain a weak tool of environmental policy;
- There is a lack of credibility when a single ministry is responsible for both the economic well being and environmental performance of an industry;
- A similar credibility gap exists in the area of reporting and enforcement.
- The absence of environmental groups during the negotiation of the covenant impoverished the process, and greatly reduced the chance of all legitimate views being heard and taken account of;
- The positive aspects of the covenant situation, over normal regulation, are not so unambiguous;
- The covenant has, albeit from a very low base, improved the scope of environmental regulation of offshore activities. Air pollution and discharges to the sea, other than oil, are covered by the covenant alone;
- The obligation placed on individual companies to develop a CEP may help them to incorporate environmental considerations into their work. However, external audits and stronger sanctions for offenders are still clearly needed.
- The effectiveness of this kind of policy instrument, with no real system of control and enforcement, is highly dependent on the goodwill of the companies and government departments involved. Where such goodwill exists, a problem does not occur, but this cannot, by any means, be guaranteed.

8.3 UNITED STATES OF AMERICA (USA)

8.3.1 New Generation of Environmental Protection

The Environmental Protection Agency (EPA) was established in 1970 in response to growing concerns about unhealthy air, polluted rivers, unsafe drinking water, endangered species, and waste disposal. EPA is responsible for implementing an ambitious set of federal environmental laws. EPA 's five year strategic plan, New Generation of Environmental Protection, lays out the guiding principles that EPA will emphasis as it works to achieve the goal of a sustainable environment and economy. EPA will be guided by a set of seven principles that apply to all programs and activities. These principles are the core of EPA's strategic plan such as ecosystem protection, environmental justice, pollution prevention, strong science and data, partnerships, reinventing EPA management, environmental accountability.

This new environmental performance system will achieve more integrated environmental management, promote environmental prevention, and enhance environmental results. It will also enable to move progressively beyond the current system which relies on numbers of permits issued, inspections made, or other similar measures. The results will be performance measures that more directly reflect changes in environmental quality. EPA will work with all states using the new environmental performance partnership system and reaching agreements on environmental performance based on an up-front assessment of environmental conditions in each state.

8.3.2 Reinventing Environmental regulation : 'end-of-the-pipe' and 'Command-and-Control' - US Lessons of the last 25 years

The modern era of environmental protection began in 1970 with the first Earth Day, the passage of landmark legislation, and the creation of the Environmental Protection Agency. The US government have accomplished much in 25 years to protect the health of people and environment , but much remains to be done, serious environmental problems remain.

From the 25 years lessons learnt found that regulations that provide flexibility - but require accountability - can provide greater protection at a lower cost *(President Clinton, 1995).* President Clintons' speach on this matter can be summaried as follows (contents token EPA WWW home page) "Many of the successes achieved thus far have been based **on 'end-of-the-pipe', 'command-and-control' approaches**. Under this system, Federal and State governments have set standards and issued permits for each environmental statute. By regulating emission sources to the air, water, and land, the country has addressed many of the obvious environmental problems. The limitations of this prescriptive regulations can be inflexible, resulting in costly actions that defy common sense by requiring greater costs for smaller returns *(President Clinton, 1995).* These approaches have proven to be blunt instruments, over controlling in some instances, under controlling in others *(EPA,1997).*

This approach can discourage technological innovation that can lower the costs of regulation or achieve environmental benefits beyond compliance. Prescriptive regulation is often less effective in addressing some of the more diffuse sources of pollution that the country will face in the years ahead. However, the government have seen both the value and the limitations of 'command-and-control' regulation and 'end-of-the-pipe' strategies. They will remain possible policy options to be chosen if they are the most efficient, effective - or only - solutions to future environmental problems. But the government also knows that we must expand available policy tools to include new and innovative ways to achieve greater levels of environment protection at a lower cost.

A healthy environment and a healthy economy go hand-in-hand. This growing awareness is demonstrated by the strong support that the sustainable development concept has received from both industry and environmentalists across the country and around the World. The economic and environment goals of the country must be mutually reinforcing to produce jobs and environmental quality.

The adversarial approach has often characterised our environmental system precludes opportunities for creative solution that a more collaborative system might encourage. When decision making is shared. people can bridge differences, find common ground, and identify new solutions.

To reinvent environmental protection, we must first build trust among traditional adversaries. Drawing upon the lessons of the last 25 years, the Clinton / Gore Administration is committed to reinventing our environmental protection system. The government will reform the system, not undermine it, and will bring people together in support of reform, rather than further polarising a debate that has been polarised for too long already. As a consequence, EPA is beginning to look at new, non-regulatory mechanisms for protecting the environment, mechanisms that build on regulatory requirements but go beyond them by encouraging **' voluntary actions'** as well."

8.3.3 Nation's New Era of Voluntary Partnership System for the Environment

Since the beginning of EPA over 20 years ago, it has become clear that all stakeholders must work together to better the nation's environmental quality. Over the last several years, an important change has been taking place in US strategy for protecting the environment. US Environmental Protection Agency (EPA) is demonstrating that voluntary goals and commitments achieve real environmental results in a timely and cost-effective way *[EPA, 1997(2)]*. EPA is building corporation partnerships with other federal agencies, state governments, tribal governments, local governments, international partners, the private sector, and the general public, including Congress to provide stakeholders with effective tools to address environmental issues such as conserving water and energy, and reducing greenhouse gases, toxic emissions, solid wastes, indoor air pollution and pesticide risk. EPA views these partnership efforts as key to the future success of environmental protection. Because the partners are achieving measurable environmental results often more quickly and with lower costs than would be the case with regulatory approaches.

8.3.4 The Voluntary Program Related to Oil & Gas Industry

8.3.4.1 Natural Gas Star Producer programme

Natural Gas Star Producer program is a voluntary, co-operative program between the US Environmental Protection Agency (EPA) and the Natural Gas Industry to promote cost effective methods for reducing methane emissions. In 1993, the first phase of the program dealing with gas transmission & distribution companies was started, and already the 39 partner companies are capturing 2 billion cu.ft of gas annually (worth almost $4 million)

Two year later, the second part of the program focused on the production sector of the natural gas industry and was started, and currently (as of June 1997) has 15 partners companies. When fully implemented in the year 2000, this program is projected to recover more than 35 billion cu. ft (worth $70 million) *[EPA,1997(3)]*.

Common Agreements and Principles

1. It is a voluntary program to promote cost effective methods for reducing methane emissions.
2. The program can increase competitiveness and maintain or enhance gas delivery service.
3. The natural Gas Star 'Best Management Practices (BMPs)' are generally cost effective for the industry.
4. the BMPs should be implemented when economically prudent as determined by the Partner based on site-specific conditions and upon the individual goals and constraints of the Partner.
5. New cost-effective technologies and practices may be added to the program.

[Source: EPA,1997(4)]

EPA' s Responsibilities

1. Designate a Natural Gas Star Program Liaison.
2. Assist Partners in program implementation:
   - Assist in removing unjustified regulatory barriers
   - Develop workshops and training courses
   - Analyse emerging technologies and practices
3. Provide Partner with public recognition.
4. Present public awards for environmental and technical leadership.
5. Recognise partners for prior practices dating back to 1990 that are consistent with program *[Source: EPA,1997(4)]*

Natural Gas Star Partner's Responsibilities

1. Appoint a Natural Gas Star Implementation Manager.
2. Determine and implement appropriate BMPs and technologies:
    - submit implementation plan within one year,
    - assist in the testing of emerging technologies,
    - Design new facilities in compliance with the program when cost effective,
    - implement plan within three years,
3. Document progress annually using estimates of emissions
4. Cooperate with EPA to publicise the program
5. Identify and replace High-Bleed Pneumatic Devices
6. Install flash tank separators on dehydrators

[Source: EPA,1997(4)]

8.3.5 Regulatory Compliance for OCS Oil and Gas Operations

The United States is a federal system and environmental legislation relating to offshore activities can be found at state and federal level. States are permitted to enact their own laws. However, most of the State legislation is similar on the whole to Federal legislation. A National Pollutant Discharge Elimination System (NPDES) general permit for all US areas is offered for lease by the US Department of the Interior's Minerals Management Service (MMS) under Clean Water Act. Oil Pollution Act 1990 is one of main regulations affecting the oil & gas industry in U.S.A

1) Oil Pollution Act 1990 (OPA)

The Act is a global one in that it applies to ships as well as offshore facilities. In broader terms it applies to Outer Continental Facilities (OCF's) which are defined as facilities located on the Outer Continental Shelf and conducting activities relating to petroleum products, including drilling, producing, starting, handling, transferring, processing and transporting.

Liability : The OPA enforces strict liability for damage from any discharge of oil from an OCF on all responsible parties which in the case of a fixed installation is the lessee or permittee of the area in which the facility is located, or the holder of a right of use and easement granted under the applicable State law.

The OPA is different from the voluntary agreement OPOL which governs the UK administration. Liability under the OPA for pollution removal where damage is caused by a fixed facility is **unlimited,** meanwhile OPOL liability is limited to $100 million *(Kimber,1994).* In the US Sector of the Gulf of Mexico, operators will likely face unlimited liability for the damage caused by any pollution incident as well as complex litigation to decide the interplay of state and federal legislation. Notwithstanding, this Act is still in its initial stages and the detailed rules which implement its broad policy statements have yet to be proclaimed.

The National Environmental Policy Act 1969 was the first significant environmental legislation within the USA and set up the general process for assessment and reporting of potential environmental effects of developments. NEPA provided for states and local agencies to establish their own environmental guidelines as long as they were no less stringent than the federal requirements. The federal and state environmental legislation does provide for the exemption of certain types of projects from the formal reporting process, although ***all projects*** must be identified and go through the application and initial study phases. The environmental analysis and reporting process is an important and mandatory precursor to the issuance of permits for any project within the USA. Generally, the environmental process within the USA is governed by the 'lead agency' which is the primary permitting agency.

2) Clean Water Act (CWA) : *40 CFR, Part 435 - 'Oil & Gas Extraction Point Source Category Offshore Subcategory Effluent Limitations Guidelines and New Source Performance Standards'*

The Act establishes a comprehensive program to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Under Section 308 of the Act, the Director must require a discharger to conduct monitoring to determine compliance with effluent limitations and to assist in the development of effluent limitations. To implement the Act, EPA is to issue technology - based effluent limitation guidelines, new source performance standards and pre-treatment standards for industrial discharges. The 1990 Consent Decree required EPA to promulgate final guidelines and standards for produced water, drilling fluids, drill cuttings, well treatment fluids, and produced sand by June 19, 1992 (which was extended to January 15, 1993).

This regulation establishes effluent limitations guidelines and new source performance standards limiting the discharge of pollutants to water of the United States from the offshore subcategory of the oil & gas extraction point source category. This rule is promulgated under authority granted to Environmental Protection Agency (EPA) by the Clean Water Act and it required by consent decree in NRDC v. Reilly, D.D.C. 79-3442 (JHP).

This final regulation under Section 301, 304, 306, 307,308, and 501 of the Clean Water Act (the Federal Water Pollution Control Act Amendments of 1972, as amended by the Clean Water Act of 1977 and the Water Quality Act of 1987). This regulation is also established in response to a Consent Decree entered on April 5, 1990 and is consistent with EPA's Effluent Guidelines Plan under Section 304 (m) of the CWA (September 8,1992: 57 FR 41000). This regulation is referred to as the offshore guidelines throughout this preamble, applies to discharges from offshore oil & gas extraction facilities, including exploration, development and production operations, that seaward of the inner boundary of the territorial seas.

The regulation at 40 CFR Part 435 establishes effluent limitations guidelines attainable by the application of the 'best available technology economically achievable (BAT)' and 'best conventional pollutant control technology (BCT)', and establishes 'new source performance standards' (NSPA) attainable by application of the 'best available demonstrated technology'. While, the existing effluent limitations guidelines, which were issued on April 13, 1979, are based on the achievement of the 'best practicable control technology currently available (BPT)'. The BPT for the offshore subgategory limits the discharge of

- **Oil & grease in produced water** to a daily maximum of 72 ppm and a 30 day average of 48 ppm;

- prohibit the discharge of **free oil** in deck drainage, drilling fluids, drilling cuttings, and well treatment fluids); and,
- **sanitary wastes,** require a minimum residual chlorine content of 1 ppm and prohibit the discharge of floating solids.

BPT limitations are not being changed by this rule *(Source: 40 CFR, Part 435 of the Code of Federal Regulations of U.S.A).* The rule establishes regulations based on BAT that will result in reasonable progress toward the goal of the Clean Water Act (CWA) to eliminate the discharge of all pollutants. Under this rule, EPA is establishing **BCT, BAT and NSPS limitations prohibiting the discharge of drilling fluids and drill cuttings from wells located within 3 miles from shore** (the inner boundary of the territorial seas). For wells located more than 3 miles from shore, BAT and NSPA limits are as follows:

- toxicity at 30,000 ppm in the suspended particulate phase;
- cadmium and mercury at 3 ppm and 1ppm, respectively, in stock barite (on a dry weight basis);
- prohibit the discharge of diesel oil;
- prohibit the discharge of free oil with compliance determined by the static sheen test.

BCT is limited to the control of conventional pollutants, and in this rule prohibits discharges of free oil **beyond 3 miles from shore.** All wells drilled off the *Alaskan coast* are excluded from the *'zero discharge'* limitation; instead, all discharge of drilling fluids and drilling cuttings of Alaska must comply with the limitations on toxicity, cadmium, mercury, free oil, and diesel oil regardless of distance from shore. Under BCT, BAT, and NSPS discharges of **'produced sand'** are prohibited and also limitations for '**deck drainage'** are being set equal to the current BPT limitations prohibiting discharges of free oil. Compliance with the no discharge of free oil limit for deck drainage is to be determined by the *'visual sheen test'.* Under BAT and NSPA of the rule, EPA's limitations on the discharge of ***'oil & grease'*** in

* **produced water** *will be* limited under BAT and NSPS to a maximum for daily maximum of 42 ppm and an monthly average of 29 ppm based on improved operating performance of gas floating technology. BCT for produced water is being established equal to the current BPT limitations on oil & grease *(40 CFR, Part 435 of the Code of Federal Regulations of U.S.A)*,

* **treatment, completion, and workover fluids** at a daily maximum of 42 ppm and a monthly average of 29 ppm. BCT for well treatment, completion and workover fluids is being set equal to the BPT prohibition on discharges of free oil (compliance by static sheen),

EPA is promulgating limitations on '**domestic wastes'** which prohibit the discharge of ***foam*** (under BAT and NSPA) and ***floating solids*** (under BCT and NSPS), incorporating US Coast Guard regulations (under BCT and NSPS) prohibit discharges of garbage (as required at 33 CFR Part 151). For **'sanitary wastes'**, EPA is promulgating BCT and NSPS limitations equal to BPT limitations on floating solids and residual ***chlorine***. EPA is not establishing BAT for sanitary wastes because no toxic or nonconventional pollutants of concern have been identified in these wastes. The summary of 40 CFR Part 435 (as amended), subpart A (Offshore Subcategory), Section 435.13 the effluent limitations guidelines representing the degree of effluent reduction attainable by BPT, BAT, BCT, and NSPS are amended as is shown in Table 8-3 to Table 8-6.

Waste Stream	Parameter	BPT Effluent Limitation
Produced water	Oil and grease	72 mg/l daily maximum 48 mg/l 30-day average
Drilling fluids	Free oil	No discharge
Drill cuttings	Free oil	No discharge
Well treatment fluids	Free oil	No discharge
Deck drainage	Free oil	No discharge
Sanitary-M10	Residual chlorine	1 mg/L (minimum)
Sanitary-M9IM	Floating solids	No discharge

Table 8-3 BPT Effluent Limitations (Promulgated 1979) *(40 CFR Part 435)*

Table 8-4 BAT Effluent Limitations *(Source: 40 CFR Part 435)*

Waste Source	BAT Effluent Limitations: Pollutant Parameter	BAT Effluent Limitation
Produced water	Oil & grease	The maximum for any one day shall not exceed 42 mg/l; the average of daily values for 30 consecutive days shall not exceed 29 mg/l.
Drilling fluids and drill cuttings		
A) For facilities located within 3 miles from shore		No discharge[1]
B) For facilities located beyond 3 miles from shore	Toxicity	Minimum 96-hour LC50 of the SPP shall be 3% by volume[2]
	Free oil	No discharge[3]
	Diesel oil	No discharge
	Mercury	1 mg/kg dry weight maximum in the stock barite
	Cadmium	3 mg/kg dry weight maximum in the stock barite
Well treatment, completion, and workover fluids	Oil and grease	The maximum for any one day shall not exceed 42 mg/l; the average of daily values for 30 consecutive days shall not exceed 29 mg/l.
Deck drainage	Free oil	No discharge[4]
Produced sand		No discharge
Domestic Waste	Foam	No discharge

1 All Alaskan facilities are subject to the drilling fluids and drill cuttings discharge limitations for facilities located beyond 3 miles offshore.

2 As determined by the toxicity test (Appendix 2)

3 As determined by the static sheen test (Appendix 1)

4 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen).

Table 8-5 BCT Effluent Limitations *(Source: 40 CFR Part 435)*

Waste Source	BCT Effluent Limitations Pollutant Parameter	BCT Effluent Limitation
Produced water	Oil & grease	The maximum for any one day shall not exceed 72 mg/l; the average of values for 30 consecutive days shall not exceed 48 mg/l
Drilling fluids and drill cuttings		
A) For facilities located within 3 miles from shore		No discharge[1]
B) For facilities located beyond 3 miles from shore	Free oil	No discharge[2]
Well treatment, completion and workover fluids	Free oil	No discharge[2]
Deck drainage	Free oil	No discharge[3]
Produced sand		No discharge
Sanitary M10	Residual chlorine	Minimum of 1 mg/l and maintained and maintained as close to this concentration as possible
Sanitary M9IM	Floating solids	No discharge
Domestic Waste	Floating solids	No discharge
	All other domestic waste	See 33 CFR Part 151

1 All Alaskan facilities are subject to the drilling fluids and drill cuttings discharge limitations for facilities located more than 3 miles offshore.

2 As determined by the static sheen test (Appendix 1).

3 As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen).

Table 8-6 New Source Performance Standards (NSPS)

(Source: 40 CFR Part 435)

Waste Source	New Source Performance Standards: Pollutant Parameter	NSPS
Produced water	Oil and grease	The maximum for any one day shall not exceed 42 mg/l; the average of daily values for 30 consecutive days shall not exceed 29 mg/l.
Drilling fluids and drill cuttings		
A) For facilities located within 3 miles from shore		No discharge[1]
B) For facilities located more than 3 miles from shore	Toxicity	Minimum 96-hour LC50 of the SPP shall be 3 percent by volume[2]
	Free oil	No discharge[3]
	Diesel oil	No discharge
	Mercury	1 mg/kg dry weight maximum in the stock barite
	Cadmium	3 mg/kg dry weight maximum in the stock barite
Well treatment, completion, and workover fluids	Oil and grease	The maximum for any one day shall not exceed 42 mg/l; the average of daily values for 30 consecutive days shall not exceed 29 mg/l.
Deck drainage	Free oil	No discharge[4]
Produced sand		No discharge
Sanitary M10	Residual chlorine	Minimum of 1 mg/l and maintained as close to this as possible
Sanitary M9IM	Floating solids	No discharge
Domestic Waste	Floating solids	No discharge
	Foam	No discharge
	All other domestic wastes	See 33 CFR Part 151

[1] All Alaskan facilities are subject to the drilling fluids and drill cuttings discharge standards for facilities located more than three miles offshore.

[2] As determined by the toxicity test (Appendix 2).

[3] As determined by the static sheen test (Appendix 1).

[4] As determined by the presence of a film or sheen upon or a discoloration of the surface of the receiving water (visual sheen).

Section 9

ANALYSIS, RECOMMENDATIONS AND CONCLUSIONS

9.1 Introduction

This section focuses mainly on analysing of the current situation of environmental compliance and enforcement regarding the upstream oil & gas industry in Thailand, and the United Kingdom. The strengths and weaknesses of the legislative and Institutional framework are analyzed. Some points of comparison between each of the studied countries are included, to provide a better understanding of the collective approaches, similarities, and differences, to complete the picture of environmental protection efforts for upstream oil & gas activities in each studied country.

For the Netherlands focus will be on analysis of a new environmental compliance and enforcement strategy; Environmental Covenants - Voluntary Agreement, regarding offshore oil and gas development. For the United States there will be focus on analysis of a new environmental management strategy - Voluntary Partnership System, and the EPA's new Limitations Prohibiting the Discharge from Offshore Oil and Gas Industry based on BCT, BAT and NSPS.

9.2 THAILAND

9.2.1 Environmental Management Policy and system regarding the oil & gas industry

Environmental management policy regarding upstream oil & gas industry of Thailand is not directly affected by Region or International Conventions. The policy is based on conservation of the natural environment and preventing pollution from the mineral exploration and exploitation.

The current environmental regulations related to these activities are not complex, but rather very flexible. The main management system is under only one government authority (DMR) and one main Act (Petroleum Act), It works as one-stop-shop system, and operates very closely with the industry. Most of the environmental protection measures are based on the industry awareness and their responsibilities which should be based on good petroleum industry practice and sound technical principles. The main problems of DMR's environmental compliance and enforcement are

- Lack of driving regulations and standards make the fundamental remit and 'job-description' vague and unclear.
- The organizational structure of the DMR for environmental compliance and enforcement, is itself confused and un-focused
- The lack of concretely defined roles and duties to be undertaken by DMR. There is unclear demarcation of responsibilities and ineffective co-operation between MFD and ED, and between DMR and other agencies. Co-operation between DMR divisions and between DMR and other Departments is not as effective as it should be.

9.2.2 Current Situation Regarding Legislation and Regulations

From the existing information in the literature review as mentioned previously there are, at present, still no laws or regulations that deal specifically in detail with environmental compliance and enforcement of Thailand's upstream oil & gas industry, although these were recommended by an Asian Development Bank (ADB) sponsored review of environmental regulations for the upstream oil and gas industry in December 1993. There are still only two main relevant Acts; the Petroleum Act 1971 and the Enhancement and Conservation of National Environmental Quality Act (NEQA)1992. There have no detailed standards or guidelines for environmental compliance and enforcement related to oil & gas industry both in the Petroleum Act 1971 and the NEQA 1992.

1) Petroleum Act

The Petroleum Act covers a wide range of environmental issues, but has little detailed regulation. There are only nine sections (Sec. 9, 12, 14, 74, 75, 80, 102* 107*and 108* (* offences and Penalties) and five Regulations (Ministerial Regulation No. 5, 6, 7, 11, 12) under the Petroleum Act concerned with environment protection for oil & gas activities in Thailand. Only in Section 75 and Section 80 of the Act 1971 are there key aspects on environmental protection, but there are very broad with catch-all phases of accepted 'good petroleum industry practices' and 'sound technical principles' in respect of the petroleum operations to prevent pollution of any place by oil, mud or any other substance.

Ministerial Regulation No 5; Article 3, has provisions concerning a range of activities which could affect the environmental performance of an operation. The Regulation requirements do not cover production operations, prevention of damage to the surface environment from seismic activity, or disposal of all wastes from the activities.

On the other hand, the current Petroleum Act 1971 concerned with environmental compliance and enforcement is flexible, and can be applied to many situations not stated in the Act itself. Thus, the result of such flexibility is nearly unlimited opportunities to use the law to develop a variety of the Department of Mineral Resources (DMR)'s environmental policies and principles. There are theoretical opportunities to clarify and consolidate the regulatory framework, by using Ministerial Regulations and DMR announcements under Section 14 of The Petroleum Act 1971 as follows:

- a simple Ministerial Regulation can be issued under the Petroleum Act to impose environmental approval procedures on the upstream oil & gas industry;

- a Ministerial Regulation or Department Announcement can be issued to impose minimum technical standards and setting of safety and environmental management guidelines on the upstream oil & gas industry;

- a Ministerial Regulation can be issued containing environmental protection quality standards specifically defined for the upstream oil & gas industry.

2) Enhancement and Conservation of National Environmental Quality Act 1992 (NEQA)

2.1) EIA Requirement for Petroleum Development

The EIA requirement for E & P activities for all capacities, under NEQA 1992, could be helpful for decision-makers to select the option that results in the least pollution, or to stop the project entirely. However, these current EIA requirements are not clear, and have no detailed guidelines. The EIA report which is required to be submitted at the time of seeking a concession may not adequate because that EIA will cover the whole concessionaire area much of which might not be necessary (too broad). The company might be required to do another EIA in every phase of the activities. So, this EIA requirement might have negative impacts which affect the company and as Hinton (1995) said that 'the regulatory habit can rapidly grow beyond reason, with increasingly stringent and costly controls that damage the economy and too often do little to protect the environment.'

However, EIA's are not required in cases where there have been other EIAs concerning project or activity of any particular type or size, or site selection for such project or activity in any particular area and such assessment can be used as a standard assessment applicable to the project or activity of the same type or size or to the site selection of such project or activity in the area of similar nature. These EIA requirements are different from ADB recommendation. The ADB' study team recommended that only the projects or activities which have the potential to result in significant environmental impacts and where detailed management and monitoring programmes are warranted, will require an EIA *(ADB,1993).*

2.2) Emission or Effluent Standards

Under Section 57, the MOSTE shall, with the recommendation of the Pollution Control Committee and with the approval of the National Environmental Board, set up the emission or effluent standards concerned with oil & gas activity whenever DMR fails to exercise its power to prescribe .

2.3) Pollution and Hazardous Waste Control for Petroleum Activities

The Act, Section 78, mentions that the collection, transport and other arrangements for the treatment and disposal of garbage and other solid wastes from upstream oil and gas development activities shall be in accordance with the governing laws related thereto. Under Section 79, if DMR did not have specific law to control pollution and hazardous wastes from petroleum activities, MOSTE shall, with the advice of the Pollution Control Committee, have a power to prescribe proper and technically sound management, treatment and disposal of such hazardous wastes by setting up rules, regulations, measures and methods for the wastes control. The current situation of the Thai legislation or regulations regarding to oil & gas activity is summarized in Table 9-1.

Table 9-1 The current situation of the Thai legislation or regulations regarding oil & gas activity

Present Situation
1. The Petroleum Act 1971 was amended 3 times in years 1973, 1979 and 1989, **all three amendments did not address environmental management in any detail.**
2. In the latest amendment of the 1971 Act in 1989, four major areas were revised and these are the fiscal regime, the land regime, role of the government and provisional clauses.
3. **Regulatory provisions** in Petroleum Act 1971 **are only very general.** no law and regulations that specifically or in detail address the E&P industry concerned with environmental management to help DMR to make decisions..
4. **The only provisions made in the Petroleum Act are unworkable vague and indecisive.**
5. **Ministerial regulations have not been sufficiently used to fill the regulatory void.**
6. **Insufficient numbers of DMR announcements have also been issued to address the regulatory weaknesses.**
7. The legal framework could be enhanced to do a lot more to act as an effective and definitive guide to enable desirable action by either the operating companies or DMR, regulating authority.
8. a Ministerial Regulation or Department Announcement can be issued to impose minimum technical standards and set of safety and environmental management standards;
9. a simple Ministerial Regulation can be issued under the Petroleum Act to impose environmental approval procedures on the upstream oil & gas industry guidelines on the upstream oil & gas industry;
10. a Ministerial Regulation can be issued containing environmental protection quality standards specifically defined for the upstream oil & gas industry.
11. under Environment Act (NEQA) 1992 the wide-ranging provisions of the main Environmental Act, the ECNEQA, only EIAs are required for the E&P industry, but previous EIAs can be used as a standard assessment applicable to the project or activity of the same type or size or to the site selection of such project or activity in the area of similar nature.
12. the requirement for EIA regarding oil & gas activities are not clear, no detail or guidelines was given for EIA of oil & gas activities,
13. no exemption for EIA requirement for every phases and every areas of oil & gas activities,
14. the EIA report which is required to be submitted at a time of seeking concession is not practical. The EIA for the whole concession is too broad and might be not necessary.
15. the EIA requirement might be negative impacts which effect to attractive of the company.
16. the industry may resist any increase in regulatory provisions, especially related to reporting requirements.
17. under Environment Act (NEQA) 1992 the MOSTE can prescript the emission or effluent standards concerned with oil & gas activity whenever DMR fails to exercise its power to prescribe .
18. under Environment Act (NEQA) 1992 if DMR did not have specific law to control pollution and hazardous wastes from petroleum activities, MOSTE have a power to prescribe proper and technically sound management, treatment and disposal of such hazardous wastes by setting up rules, regulations, measures and methods for the wastes control.
19. Major omissions from the present regulatory provisions include: • formal requirements for environmental monitoring • system of for EMSs and environmental audits • formal requirements environmental permit • standards to define expected levels of environmental performance • formal requirement for environmental reporting • environmental management guidelines

9.2.3 Current Institutional Framework - analysis

DMR is the only key authority directly acting as one-stop-shop responsible for upstream oil & gas industry in Thailand. The duties of the MFD related to environmental issues are: the enforcement of the Petroleum Act and Regulations, safety and environmental standards. Due to lack of regulations, rules, standards, guidelines and formal environmental staff for environmental matters for oil & gas activity, DMR cannot act as an active agency dealing with environmental matters. At present, DMR seems to rely on rules and standards brought in and exercised by international aspects of petroleum development and depends heavily on practices adopted by oil and gas companies. This might present problems when dealing with companies which adopt lower standards of practice *(Trisan,1993 in the Report to DMR,1996).* The current situation of the **'competent officers'** *(or MFD inspector)* can be analyzed as follow:

a) Mineral Fuels Division (MFD)

- most of MFD inspectors are junior Engineers or Geologists. Some of them have not much or enough work experience in environmental management,
- most of them do not have any education background related to 'environment management', and there is not enough environmental management training for the officers,
- no environmental standards or guidelines for the officers,

b) Environment Division (ED) officers

- The present situation is that there are no parts which cover petroleum activities in the Environment Division, except some cases which are commanded by the Director-General,
- Officers only act on short term projects of environmental inspection in general and / or spot checks for petroleum activities,
- Most of environmental scientist staffs in ED have no background or enough / work experience about 'upstream petroleum development activities,

- there are not enough environmental scientist staff in the Division (currently, 18 only). Most of their responsibilities are concerned with mining development.

The current situation of the Thai Institutional structure regarding oil & gas activities can be summarized in Table 9-2.

Table 9-2 The current situation of the Thai Institutional / Administrative capacity

Present Situation
1. DMR continues to perform its environmental management duties to the best of its capability. 2. There are a number of internal and external issues concerning the DMR which would have to be addressed in the development of any future system. 3. **Lack of driving regulations and standards make the fundamental remit and 'job-description' vague and unclear.** 4. **The organizational structure of the DMR for environmental management, is itself confused and un-focused** 5. **The lack of concretely defined roles and duties to be undertaken by DMR.** There is unclear demarcation of responsibilities and ineffective co-operation between MFD and ED. Co-operation between DMR divisions and between DMR and other departments is not as effective as it should be. 6. There are no formal environmental reporting requirements by DMR. 7. There is **lack of well-considered and structured work goals, strategies, programs and protocols.** 8. There is a lack of appropriately qualified and skilled personnel to carry out environmental compliance and enforcement work. Present government policy on staff levels tend to limit the opportunities for expansion. 9. There may be a continued lack of political will for effective environment and resource management.

9.2.4 Assessing the present situation of Thailand by SWOT Analysis Technique

DMR's present situation regarding the environmental compliance and enforcement regime for the upstream E&P industry was analysed by using '**SWOT analysis technique'**. This technique analyses strengths, weaknesses, opportunities, and threats of the whole organization.

Strengths : The strengths are those areas of system control or performance that are positive. These are areas to build-on in developing and moving forward.

Weaknesses : These are areas where system control or performance appears at risk: where practices, procedures or processes indicate some opportunity for failure. These are areas that the action plan will focus on.

Opportunities: These are areas where new actions or initiatives may bring benefits. These will need to be followed up in the action plan.

Threats : These are risks which may not be clearly apparent but which may damage the short - or long term development of the organization. These may need policy formulation before actions are implemented.

SWOT analysis of the DMR's present situation regarding to environmental management for oil & gas industry is summarized in Table 9 -3.

Table 9-3 SWOT analysis of the DMR's present situation

FACTORS IN THE INTERNAL ENVIRONMENT **STRENGTHS (S)**
1. DMR has basic environmental policies for E&P industry. 2. Previous EIAs can be used as a standard assessment applicable to the project or activity of the same type or size or to the site selection of such project or activity in the area of similar nature. 3. DMR has a budget for environmental protection. 4. Environmental Division (ED) has already been established. 5. **There are some experiences from the present low-level environmental inspection work for E&P activities by the Mineral Fuel Division (MFD) and ED. The DMR is the only environmental agency that has experience with the E&P industry.** 6. DMR has a good computer system. 7. There **is good and close relationship between DMR and the industry.**
WEAKNESSES (W)
1. **Regulatory provisions are only very general. There are currently no formal environmental reporting, except only EIA,** 2. **Organizational and administrative aspects are unfocussed and undriven by laws.** 3. **There is a lack of systematic work goals, strategies, action plans, protocols and guidelines.** 4. **Human resources and skills are inadequate.** 5. There is unclear demarcation of responsibilities and ineffective co-operation between MFD and ED, and between DMR and other agencies. Co-operation between DMR divisions and between DMR and other departments is not as effective as it should be. 6. Certified analytical laboratory capacity is limited. 7. Oil companies are confused as to which government agency to report to regarding environmental matters. 8. Low salaries, promotion prospects, etc. encourage important personnel to seek employment in private sectors. 9. The above factors also create higher risks of corruption amongst government officers. 10. Access of DMR officers to E&P facilities is limited, and unannounced visits to offshore installations are impossible. 11. There is a lack of environmental baseline data for E&P activity. 12. DMR has not developed public awareness over the environmental issues.
FACTORS IN THE EXTERNAL ENVIRONMENT **OPPORTUNITIES (O)**
1. **To develop an appropriate compliance and enforcement program (CEP) virtually from scratch.** 2. **Most operating companies already have some level of effective environmental management capabilities, often to international industry standards and guidelines.** 3. Public awareness, understanding and concern over environmental issues in general will increase. 4. **Thailand could ratify MARPOL and other international agreements and there are pressures to ratify and uphold international treaties.** 5. Provisions of the Environmental Quality Act can potentially be extended to provide a firmer regulatory basis for DMR's work in the E&P industry. 6. As necessary, DMR can seek advice from other environmental agencies regarding the working of its new roles and duties. 7. DMR could learn from the corporate experience of the industry regarding environmental management. 8. **The existing broad but rudimentary legislative framework could be further improved.** 9. **The present basic organization in DMR could be developed.**

Table 9-3 SWOT analysis of the DMR's present situation *(continued)*

THREATS (T)
1. The requirement of the Act 1992 do not cover environmental reports, such as environment assessment or based line study survey, monitoring or auditing for the E&P industry
2. There is a danger that some environmental management work will be 'poached' by other environmental agencies if DMR does not consolidate its position.
3. The good relationship between DMR and the industry may be strained if DMR starts to behave more firmly.
4. Inconsistent political backdrop may threaten continuity and stability in the public sectors.
5. The slow and complex decision-making processes by the public sector may inhibit the efficiency and responsiveness of DMR.
6. Environmental issues in Thailand are often likely to be politically charged, making the DMR's work more complicated and sensitive.
7. There may be less opportunity for DMR personnel to take up training abroad and to participate in conferences related to environmental management of the E&P industry.
8. The current lack of general environmental management information and research related to the E&P industry in Thailand may tend to persist.
9. The document 'Laws and Standards for Pollution Control in Thailand' does not specify which requirements are intended for the E&P industry.

By using the SWOT analysis technique to pointed out the DMR's present situation of environmental management for oil & gas industry it is suggested that DMR can improve its own administration regard to environmental management by use strategies as shown in Table 9-4.

Table 9-4 Environmental Factors and Strategies for DMR administrative

1. STRENGTHS & OPPORTUNITIES S_4 - DMR experience ⇒ *continue to develop expertise* O_1 - can develop CEP from scratch ⇒ *prepare CEP action plan* O_2 - industry experience ⇒ *involve industry in CEP development* O_4 - ratification of MARPOL ⇒ *seek ratification*	*2. WEAKNESSES & OPPORTUNITIES* W_1 - provisions only basic ⇒ *tighten the law's requirements* W_2 - lack of law to define DMR's work ⇒ *amend law to support DMR's roles* W_3 - poor goals, strategies, planning, ⇒ *develop an E&P management plan* W_4 - human resources problems ⇒ *recruit and train* O_8 - poor regulatory framework ⇒ *clarify regulatory framework* O_9 - weak administrative capacity ⇒ *set up E&P Environmental Section*
3. STRENGTHS & THREATS S_6 - good relationship with industry ⇒ *maintain by working closely*	*4. WEAKNESSES & THREATS* T_1 - industry may resist ⇒ *reassure companies, discuss issues* T_2 - lack of political will ⇒ *ensure politicians' awareness of issues* T_3 - government staffing policy ⇒ *make CEP high priority in human resource development*

Key: *S_1 etc. = Strengths, factor 1, etc. [from original SWOT analysis]*

From Strengths & Opportunities of DMR : DMR can plan to develop an appropriate compliance and enforcement programme (CEP) virtually from scratch, and also can prepare a CEP action plan. Using industry experience, DMR can involve industry in CEP development. DMR have some experiences from the present low-level environmental inspection work for E&P activities by MFD and ED officers (from S_4 in Table 9-2), thus DMR can continue to develop environmental expertise in a group concerned with the oil & gas industry.

From Strengths & Threats of DMR : DMR can maintain good relationship with industry by working more closely.

From Weaknesses & Opportunities of DMR : To solve the weakness about basic provision, DMR should tighten the law's requirements and should amend law to support DMR' role to solve the weakness of lack of law in defining DMR' s work. The weakness of poor regulatory framework, goals, strategies, plannings can be solved by clarifying the regulatory framework and develop an E&P management plan. Also DMR should recruit and train the formal environmental group concerned with E&P activities.

From Weaknesses and Threats of DMR : To solve the Threat of lack of political will, DMR should ensure politicians' awareness of issues and make CEP a high priority in human resource development to the government staffing policy.

9.2.5 Main Recommendations

The main recommendations for improving the identified weaknesses fall into two categories:

1. **DMR capacity building**
2. **Enhance regulatory framework**

These two main points need to have a good system of policy, planning, implementation, auditing, and education, which should include efficiency, effectiveness, economic, reliability, convenience, and workable. Most of this recommendations are applied from the UK, USA, the Netherlands and ADB' recommendations Strengths as shown in Fig. 9-1 and from the researcher's opinion. The outline for improving DMR effectiveness is shown in Fig. 9-2.

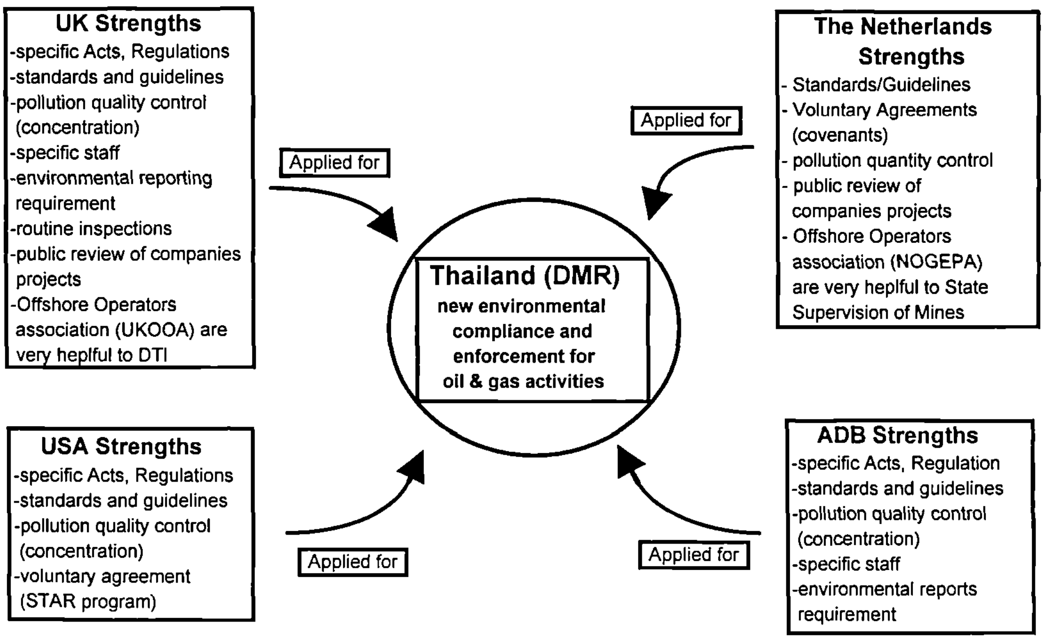


Fig. 9- 1 New ideal for Thailand regarding environmental compliance and enforcement for oil & gas activities

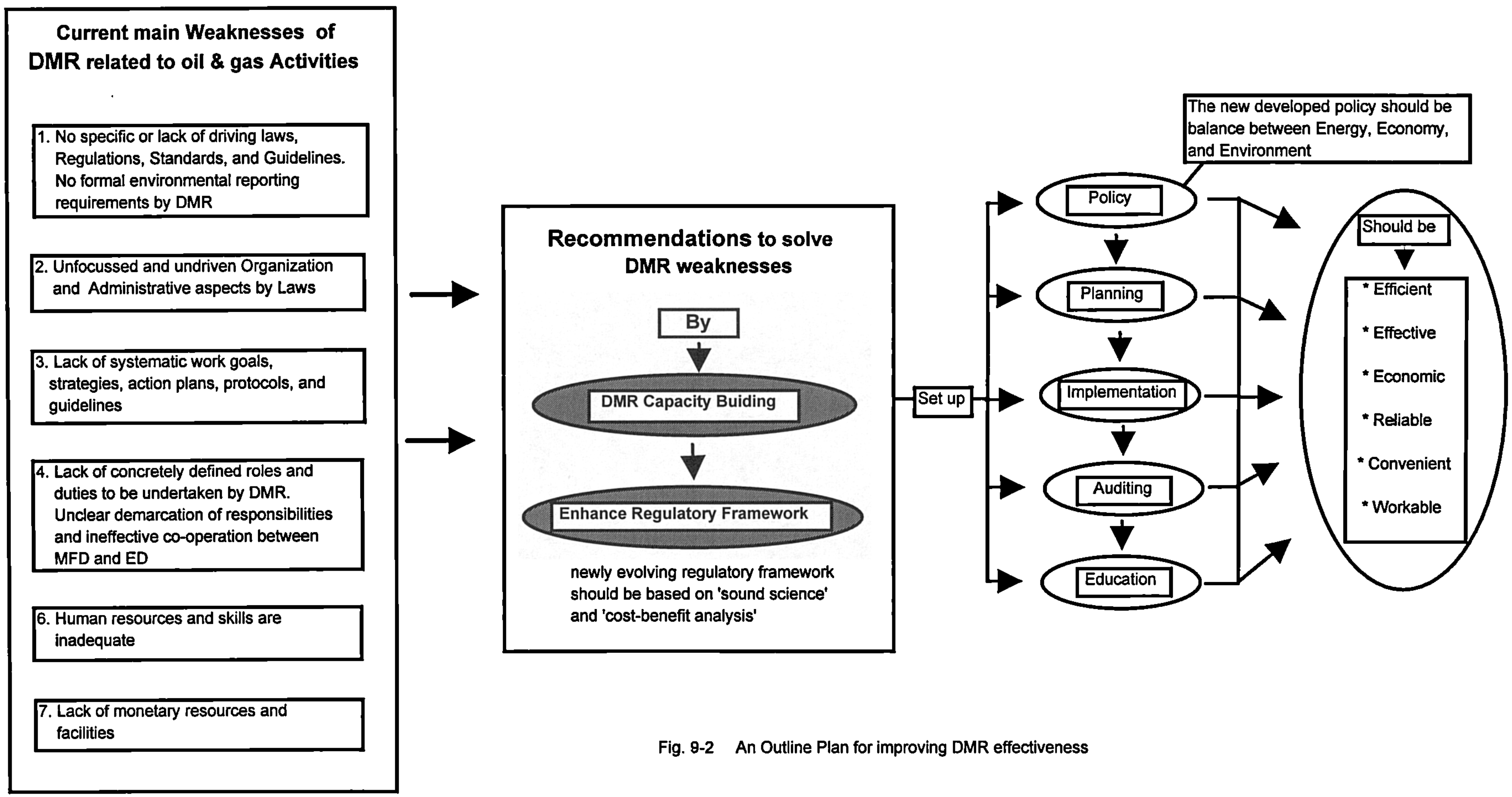


Fig. 9-2 An Outline Plan for improving DMR effectiveness

9.2.5.1 DMR capacity building

a) Setting Up A New action Staff / Team

To improving this weaknesses, the first recommended priority is for the DMR Director-General to set up a new staff / team work within 1-2 months to make plans to organize / manage this weakness. The new team should have representatives from MFD and ED. The representative from MFD should be a senior geologist from the Exploration Section and a senior petroleum engineer from the Production Section. The representative from ED should be a senior environmental scientist. All of these representatives should have responsibility for full time work only for the specific target for urgently setting up a project for environmental compliance and enforcement regarding to oil & gas activities. This new team should consult with the Director of MFD, ED, and with the relevant Division of DMR such as Office of the Secretary, Legal advice Section, Technical and Planning Division, Personnel Division, and maybe with the consultant. An outline plan for a new staff/ team is shown in Fig. 9-3.

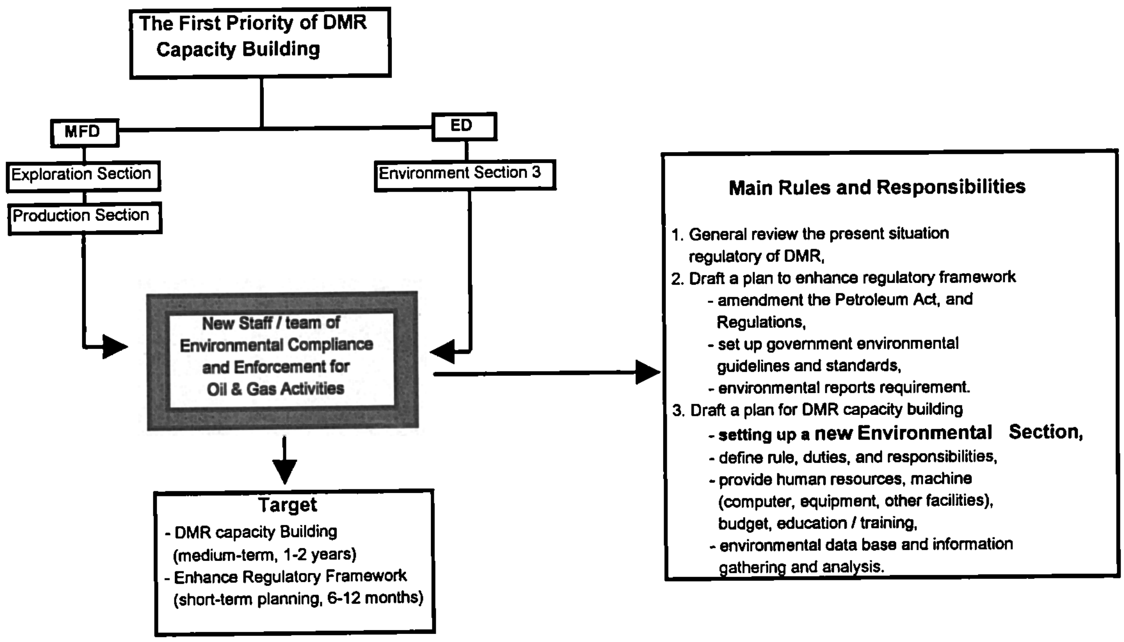


Fig. 9 - 3 Outline of plan for the First Priority for improving DMR Capacity Building regarding Environmental Compliance and Enforcement for Oil & Gas Activities

b) New Environmental Section

DMR needs to establish a new Environmental Section regarding Oil & Gas activity as one sub-system of the DMR system. This section should be set up within MFD to act as a one-stop-shop as per ADB the recommendation. The researcher agrees with ADB because it should work more effectively and especially reduce steps and time of decision-making and co-operation processes between the relevant sub-systems in MFD.

b.1) Information Flow of the New Environmental Section

See the proposed structure and information flow of the new Environmental Section in Fig. 9-4. From Fig. 9-4 show the direction of information flow within DMR sub-systems. The new Environmental Section will co-operate with the relevant Sections of MFD, such as Concession Section, Exploration Section, Production Section, and Data Section. Also the new Environmental Section should consult with Environment Division on a case-by-case basis. So, the environmental information will flowed between them. The head of the three sub-sections of the new Environmental Section will report their activities (environmental compliance and enforcement) directly to the head of Environmental Section. The head of Section will make decisions and report to Director of MFD. This information will flow directly from Director of MFD to Director-General of DMR. The Director-General will make the final decisions and give feed back (information) to Director of MFD.

External information will flow between the new Environmental Section with the other relevant authorities such as office of Environmental Policy and Planning (OEPP) for EIA report and seek advice on a case-by-case basis. The oil & gas companies should send their environment reports to the new Environmental Section for review and recommendations.

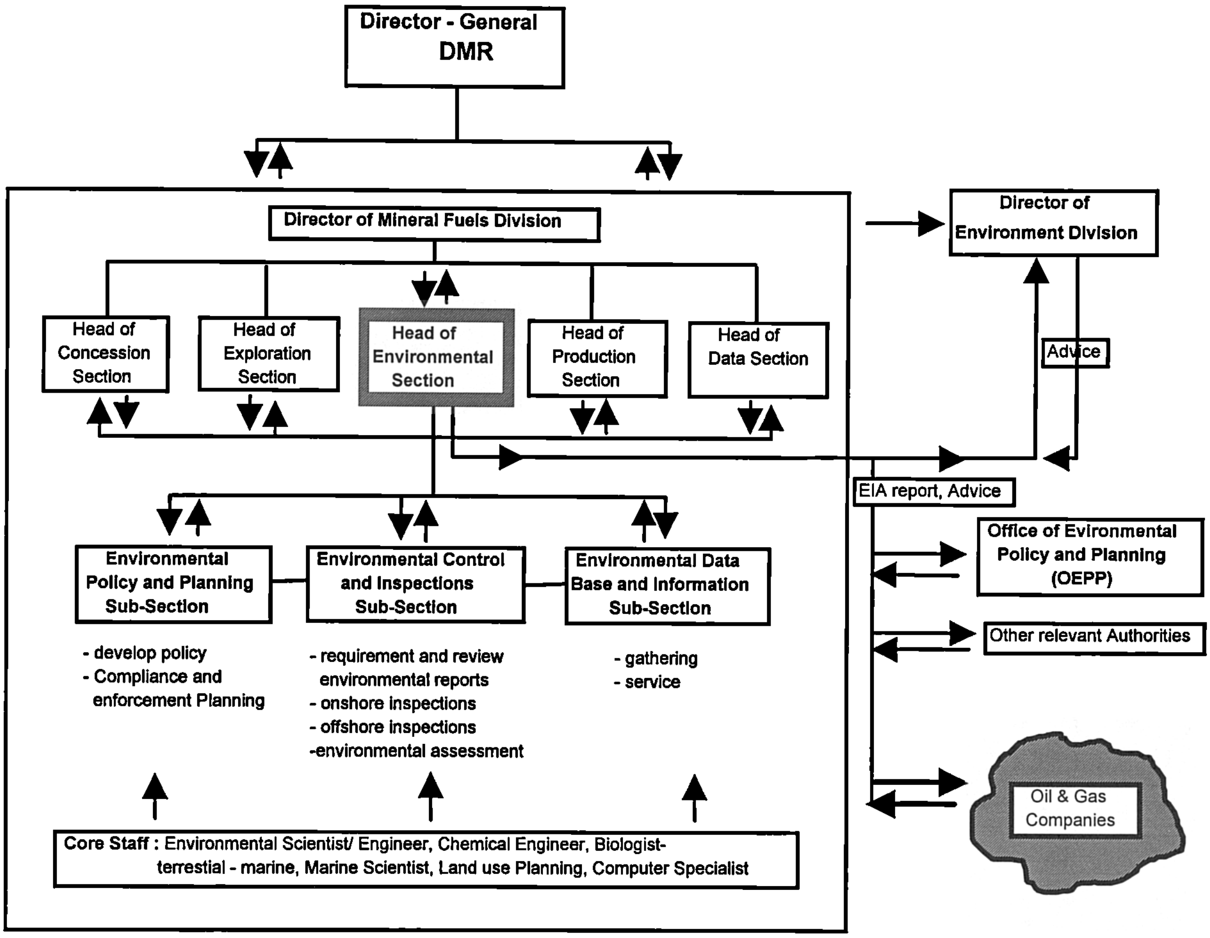


Fig. 9 - 4 Proposed New Environmental Section Structure and Information Flow

b.2) Main Input (Resources) for the New Environmental Section

This new sub system needs to be taken seriously and therefore supported adequately by main 3M input resources, M-manpower, M-machine (computer, equipment (both for office works and field works), and other facilities), M-money (budget). Education and training is important to develop the efficiency of manpower. The input and output of the new Environmental Section (sub-system) and main responsibilities of the new Section are show in Fig. 9-5.

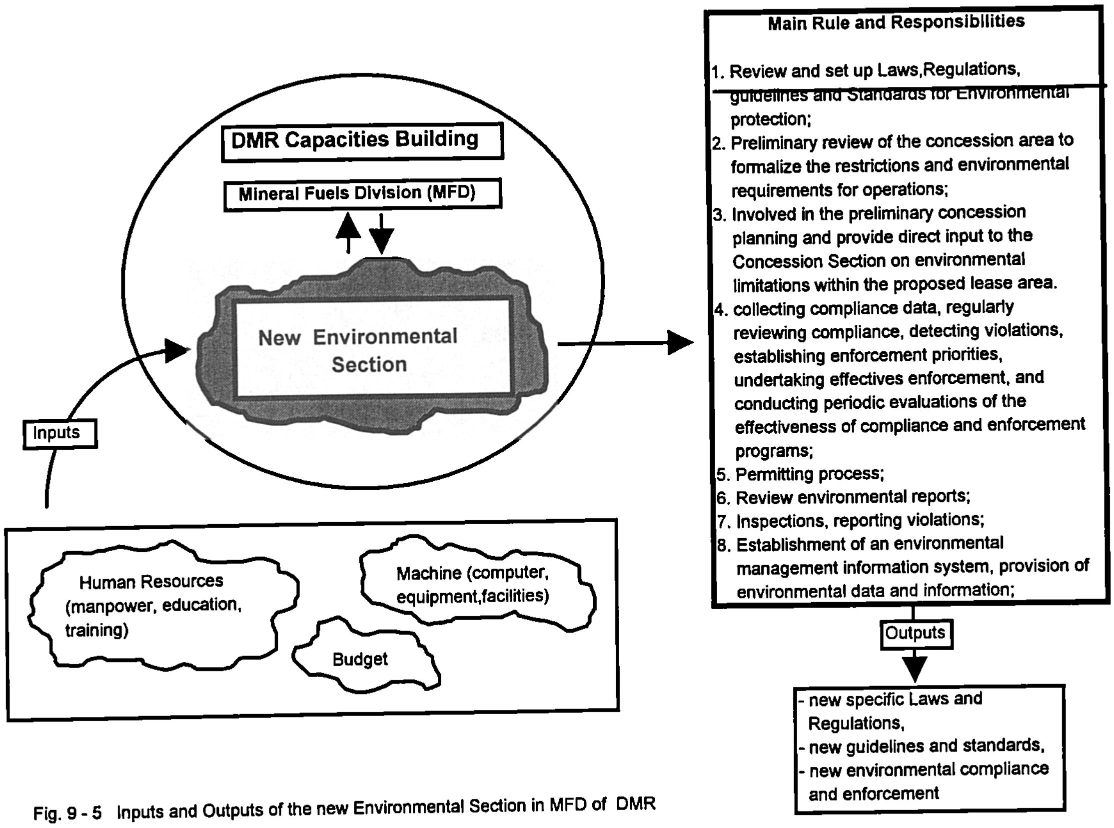


Fig. 9 - 5 Inputs and Outputs of the new Environmental Section in MFD of DMR

9.2.5.2 Recommendations for Enhancing Regulatory Framework

To solve the one main weakness of DMR relating to the lack of specific driving laws, Regulations, standards, and guidelines and the lack of formal environmental reporting requirements by DMR, DMR should push for the amendment of the Petroleum Act, amend and set up new Regulations, standards, and guidelines for environment compliance and enforcement by applying from the described UK, USA, the Netherlands, and ADB' recommendation. See outline of the proposed enhanced regulatory framework in Fig. 9-6.

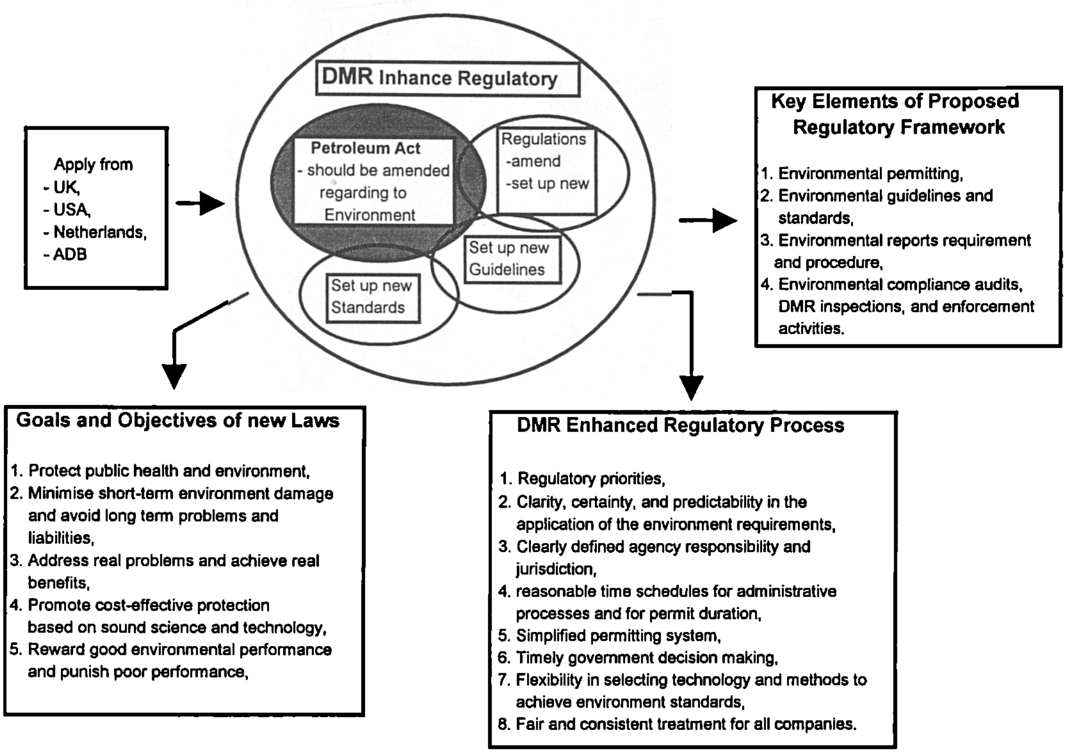


Fig. 9- 6 An Outline of Proposed Enhanced Regulatory Framework regarding Environmental Compliance and Enforcement for Oil & Gas Activities

9.3 THE UNITED KINGDOM

9.3.1 Environmental Management Policy and System

The UK environmental management policy regarding oil & gas industry is strongly influenced by the European Community, PARCOM, and various directives concerning pollution which now exist. The UK policy approaches being adopted are as follows:

- Integrated Pollution Control (IPC),
- Consent to Discharge,
- Greater Public Scrutiny,
- Criminal Sanctions,
- The Right of Appeal.

Some of these approaches have yet to be implemented for the offshore oil & gas industry.

9.3.2 Current Legislative Framework- analysis

The UK's regulatory approach to the control of discharges arising from offshore operations can be summarised as :

- prohibition and exemption from prohibition;
- best practicable means requirements;
- compliance with emission limits.

All of these approaches have been variously adopted in order to meet the requirements of international conventions which the UK has ratified and generally to provide for the protection of the marine environment. There are many existing Acts and regulations affecting offshore oil & gas activities in UK.

a) Discharge prohibition / standards

In the UK, offshore operators are required to obtain an exemption from the requirements of relevant legislation in order to discharge materials from their installations. Regularly updated guidelines or standards are issued which form the basis of exemption requirements and these are based on Paris Commission (PARCOM) recommendations and discussions with industry. Many of the current standards to which the UK offshore industry has to adhere are universal in their application and probably reasonable, because the standards that have determined on the basis of technical feasibility and are generally based on evaluations of scientific data and information and seek to apply generalized risk assessment to individual situations.

Discharges from offshore installations during operations are covered by several international conventions and the EC Directive which have, in large, been subsequently implemented in the UK by various Acts of Parliament and Regulations. Environmental regulation of offshore installations is currently enforced through controls placed on the quality and quantity of wastes. There are currently various amounts of existing legislation covering discharges from offshore installations to the marine environment, but not emissions to the atmosphere, which is an important issue. Many of the most important items of UK environmental legislation, such as the Duty of Care Regulations, relating to waste management, and the Applications, Appeals and Registers Regulations concerning licensing of industrial emissions, do not apply to most offshore installations. The existing legislation is quite strictly controlled especially about oil pollution, such as from oil- based- muds, produced water, oily cutting, in response to international agreements.

b) License Condition: Key for environmental management

DTI use license conditions as a main key to protect the UK offshore environment. The condition's requirements for the environment are given in detail and are quite clear, make sense, and are practicable. A series of conditions, are consulted by the representations of various related Government departments and agencies.

c) EIA Requirement related to E&P Industry

At present, the Government is currently consulting on the regulations needed to be put into law under the EC Directive 85/337 on EIAs as it applies to oil & gas projects. Specified thresholds in this latest Directive will be applied this year (1997).

9.3.3 Current Institutional Framework

Environmental issues offshore are controlled principally by one authority (DTI, Oil and Gas Division). However, DTI also work inclose consultation with fisheries departments (MAFF, SOAEFD) and Department of Environment, Transport, and the Region (DETR) which deals with oil spills. For onshore areas, the environmental compliance and enforcement are a lot more complex than offshore. These are controlled by planning systems which are related with various authorities and Act / Regulations. EIA are required under planning system management. The main strategies that DTI use for offshore environmental protection are environment reports from the operations and routine inspections. The DTI inspection is scoped by confidential Checklist Inspection Forms. Baseline survey and monitoring are also the main tools to control the impacts from the offshore operations. Also DTI has been using guidelines and standards to control the environmental impacts in their environmental compliance and enforcement.

9.3.4 Assessing the present situation of UK by SWOT

The present situation of the environmental compliance and enforcement regarding to upstream oil & gas activities in UK can be analysed using the SWOT analysis technique. The strengths, weakness, opportunities and treats of the whole organization are summaried in Table 9-5.

Table 9-5 SWOT analysis of the DTI's present situation

FACTORS IN INTERNAL ENVIRONMENT STRENGTHS (S)
1. DTI has strong basic environmental polices for upstream oil & gas industry. 2. DTI full of Acts / Regulations, guidelines and standards for E&P environmental management in their own system for decision-maker. 3. DTI organizational and administrative aspects are very focused and driven by both UK national laws and by PARIS and international Conventions and law. 4. There are full of systematic work goals, strategies, action plans, protocols for DTI officers. 5. The formal environmental staff in Oil and Gas Division has already been established. 6. The environmental officers have long and adequate experiences from the both policy and work levels. 7. There is a good and close relationship between DTI and the related authorities and include the industry, UKOOA. 8. DTI can request any help such as research, laboratory work etc. from the UKOOA. 9. DTI has good computer systems and other office facilities. 10. There are full of environmental baseline data, monitoring, general environmental management information and research related to the E&P activity. 11. Public inquiry is one tool of the environmental management system of DTI. 12. DTI sees giving the public greater access to environmental information as a further means of encouraging the industry to act in an environmentally responsible way.

Table 9-5 SWOT analysis of the DTI's present situation *(continued)*

FACTORS IN INTERNAL ENVIRONMENT
WEAKNESSES (W)

1. The UK legislation system is very complex, there are many pieces of law which can be confusing.
2. Some legislation, guidelines and standards are too strike and might give problems to the small oil companies which have older technologies.
3. There are no standards for air emission from offshore oil & gas activities.
4. There are many related authorities and it might produce conflict between them. Also this can confuse the industry.
5. There are currently no requirements for some environmental reports such as environmental audits which might help DTI decision-maker.
6. DTI has no budget, man power nor environmental inspectors to carry out large-scale EIA or environmental monitoring for the whole UKCS which has oil & gas activities.
7. Access for DTI inspectors to offshore E&P facilities is limited, and unannounced visits to offshore installations are difficult.

FACTORS IN THE EXTERNAL ENVIRONMENTAL
OPPORTUNITIES (P)

1. DTI can apply the North Sea countries E&P guidelines and standards, because they are in the same environment.
2. Environmental policies for E&P activities of UK government are strongly affected by PARIS and International Conventions which UK ratified.
3. DTI can seek advice from other environmental agencies and UKOOA.
4. The UKOOA has shown willing to protect the environment of UK country, most of the operating companies already have a high level of effective environmental management capabilities, often to international industry standards and guidelines.
5. The UKOOA is also very highly experienced and is able to advice the UK government, DTI, set up or improve the new guidelines and standards for environmental management.
6. The relationship between the North Sea countries is very close and strong, UK can work very closely with the other North Sea countries to protect the environment from E&P activities.
7. Public awareness, understanding and concern over environmental issues in general and specific in pollution sources from oil and gas activities are increasing.

THREATS (T)

1. NGOs and the other sea user in UK North Sea are very strong power, might have conflict between oil & gas industry and them, especially fishery industry.
2. Environmental issues in UK and North Sea countries are often likely to be politically charged, making the DTI's role more complicated and sensitive.
3. The UK environmental management policy regarding to oil & gas industry is strongly influenced by the European Community, PARCOM, that can have effects on a new investment of the industry.

9.4 Comparison of Environmental Compliance and Enforcement regarding to oil & gas industry between Thailand and UK

9.4.1 Main Similarities

a) Legislation : Both countries use a legislative system (Act, Regulation) to protect the environment.

b) Institutional : Both UK and Thailand have only one main direct authority to respond to environmental protection by consulting with the related authorities.

Environmental Report : most of environmental management of both countries is controlled by reviewing the company environmental reports which are required by law in UK but not in Thailand.

For inspection : both UK and Thailand have inspection systems to protect the environment.

Taking Environmental Samples : the authority are not required to do this by Act or Regulations both UK and Thailand, and this is one of the company responsibilities.

9.4.2 Main Differences

a) Legislation : There are no specific Acts or Regulations, no standards and no guidelines regarding oil & gas activities in Thailand. Thailand has only one main Act (Petroleum Act) to control the whole phases of oil and gas activities.

It is quite different from UK system, in UK there have many specific Acts and Regulations regarding to oil & gas activities. There are at least 35 Acts, 62 Regulations, and 20 orders for offshore activities, and also a lot of guidelines and standards for environmental protection from offshore oil & gas activities. Most of the UK legislation is specific for different of activities, such as Installation and pipeline licensing, Installation and pipeline abandonment which are under different Acts and Regulations. Onshore and offshore licensing has different Environmental Compliance and Enforcement Procedures, and are undered different legislation. **The requirements from legislation** in UK are more complicated and stricter than Thailand's but Thailand' s legislation is more flexible than UK's.

b) Institutional : In Thailand, all of petroleum activities both onshore and offshore are controlled by one authority, DMR, which act as one-stop-shop. But, in UK, there are different authorities responsible for Environmental Compliance and Enforcement for onshore and offshore activities. DTI are responsibility for offshore and exercised under main six Acts. There is a lack of well-considered and structured work goals, strategies, programmes and protocols in the Thailand, DMR, system when compared with the UK.

Environmental reports, in UK are required by law, but not in Thailand. At present, in Thailand, only EIA are required by Act, but in UK are not required by Act. However, Base line Survey and Environmental Monitoring reports are required in UK.

Environmental Staff, In UK, DTI, have a formal staff to responsibilities for environment, but Thailand does not have.

For inspection, UK has a routine environmental inspection system to protect the environment by using confidential checklist forms, but not in Thailand. Thailand has only environmental spot checks for case by case. However Thailand have inspectors (competent officers), DMR(MFD) to stand by at the operation site both offshore and onshore for 24 hrs, but not in UK. The DMR competent officer has powers to inspect the petroleum operation and give a written instruction to the concessionaire to refrain from any performance which may cause damage to persons or to properties of other persons. The general comparison of the Environmental Compliance and Enforcement in Thailand and UK are summaried in Table 9-6 as below.

Table 9-6 Comparison of Environmental Compliance and Enforcement

THAILAND	UK
Legislation: - **one** main direct Act (Petroleum Act 1971- Key Act), - one main in general Environment Act (Environmental Quality Act 1992)	29 international laws (since 1954), 44 EC laws (Directives /Decisions /Regulations)(since 1967), 117 UK Statutes (*35 Act, 62 Regulation, and 20 order*), The Petroleum (Production) Act 1918 amended in 1934 - Key Act
Legislation Requirement : very broad, no detail in guideline and standard, good petroleum practice, good environmental management.	full of detail of guidelines and standards
Environmental Management Methods/tools: **Baseline Surveys** no requirement	- Pre & Post drilling operational are required for Sea bed Survey in sensitive area, - drilling in case of use oil-based muds are required statutory sea bed surveys - installations decommissioning require sea bed surveys
Environmental Monitoring : no required, voluntary basis	- seabed monitoring is required by follow DTI guidelines and condition as follow : - seabed monitoring is required when oil base muds are used in offshore drilling operations (only in terms of chemical contaminants),

Table 9-6 Comparison of Environmental Compliance and Enforcement *(continued)*

THAILAND	UK
	- seabed (chemical and biological) sampling programme is required to monitor (usually for hydrocarbons) during the drilling phase of development, chemical survey is required • one year after the commencement of drilling, or drill of five wells, whichever is the longer duration, • every two years or future ten wells drilled, which takes longer, • further surveys of greater detail may be ordered if the results are deemed to warrant it. • no direct monitoring of effluents either chemical or toxicity, - extensive voluntary monitoring of the chemical and biological parameters of seabed sediments (especially effects of drilling cuttings discharges), and water column (concentrated on water chemistry effected to marine life)
EIA : EIA is required for all capacities (both onshore and offshore)	- the development of near-shore oil & gas fields is subject to the process of EIA., which is required by license conditions, not required by DTI. - New EU Directive (EIAs) will be applied for offshore oil & gas activities this year (1997),
Auditing : not required	no statutory requirements
Oil Spills Plan: are required	nearshore license blocks do have specific requirements for oil spills during exploration activities. There is no definition of the term 'near-shore' but blocks lying wholly or partly within 25 miles of the shore and within bay closing lines would be considered by DTI
Standards Waste: no limit	required by Act
Environmental Guidelines: no specific guidelines	full of guidelines especial wastes management
Administration Government : only one main key authority, Department of Mineral Resources (DMR), Mineral Fuels Division-MFD, responsible for oil&gas activities in Thailand	Department of Trade and Industry (DTI), Oil&Gas Division - Key Authority responsible for offshore installations and pipelines

a) Comparison of the Currently of Environmental Compliance and Enforcement between Thailand and UK.

The environmental compliance and enforcement system regarding oil & gas activities between Thailand and UK are compared by flow charts as shown in Fig 9-7 and 9-8

b) Comparison of the Information Flow of Environmental Compliance and Enforcement between Thailand (DMR) and UK (DTI)

In Thailand, the environmental compliance and enforcement regarding oil & gas activities is summarised in Fig. 9-9. The oil & gas activities include environmental effects are controlled directly under Mineral Fuels Division (MFD). Petroleum Exploration Section and Petroleum Production Section of the MFD are responsible directly for Environmental pollution from exploration and production activities phases, respectively. The officers (Geologist and Engineers) must report (daily, weekly, monthly with specific, and other reports) all their activities (both in office work and field works) include environment (in low-level work) to the Director of MFD, then the Director should report to Director-General of DMR for decision making. Most of all information including environmental data are collected at Petroleum Data Section. However, there are currently no environmental officers in MFD and also no formal staff response for environment in MFD. Also there are no specific Laws or guidelines or standards for MFD decision making or for the industries.

The Environment Division (ED) has currently no formal responsibility directly to do with environmental compliance and enforcement regarding the oil & gas activities. In the past, there was only a short term project which was specific environmental inspection (spot check) for oil & gas activities. However, the Director-General of DMR can command the ED to report to him on a case by case basis about environmental problems and controls concerned with oil & gas activities. At present, there is a lack of special experts in the petroleum field; there is only one senior environmental responsible for oil & gas activities in this Division.

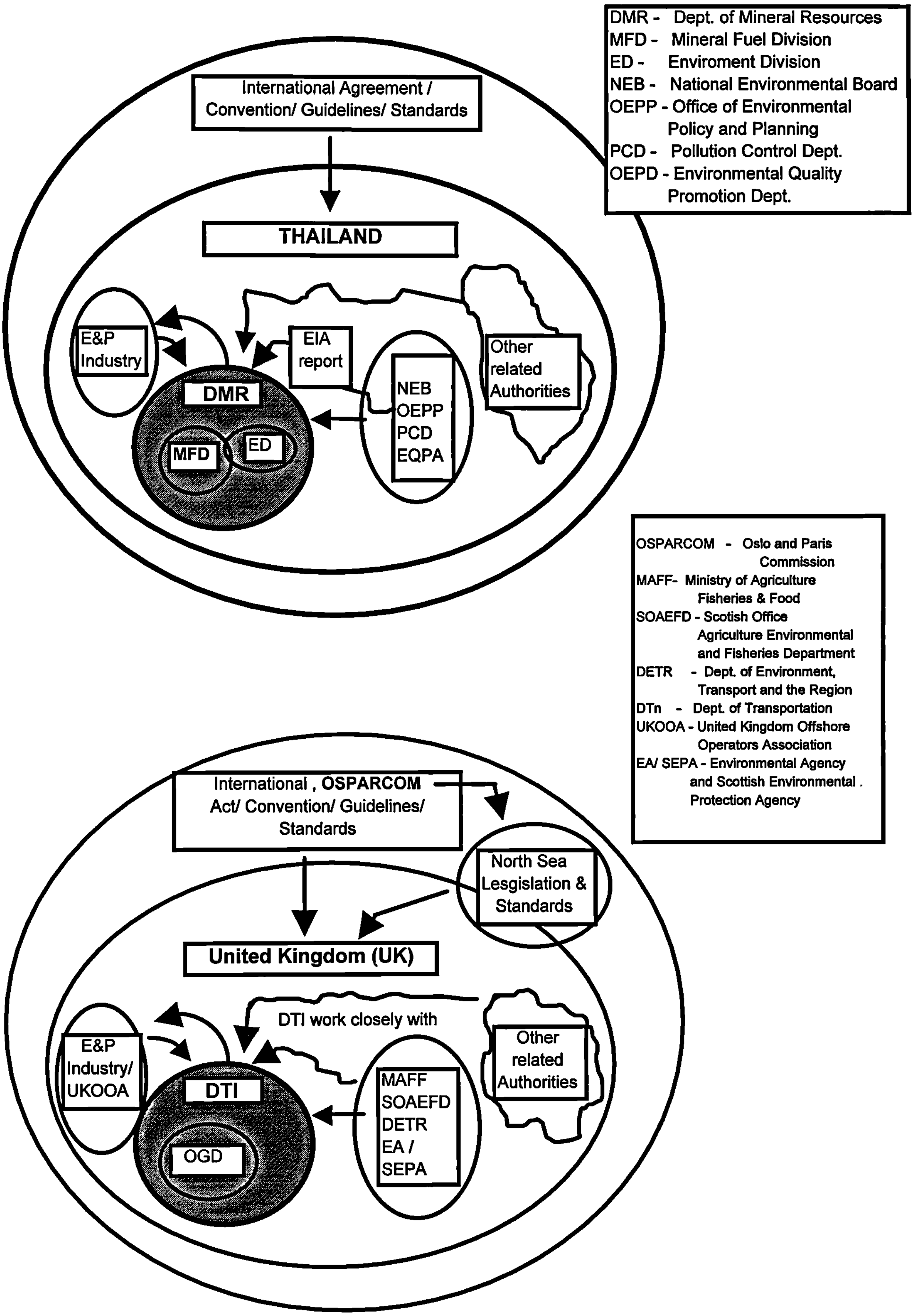
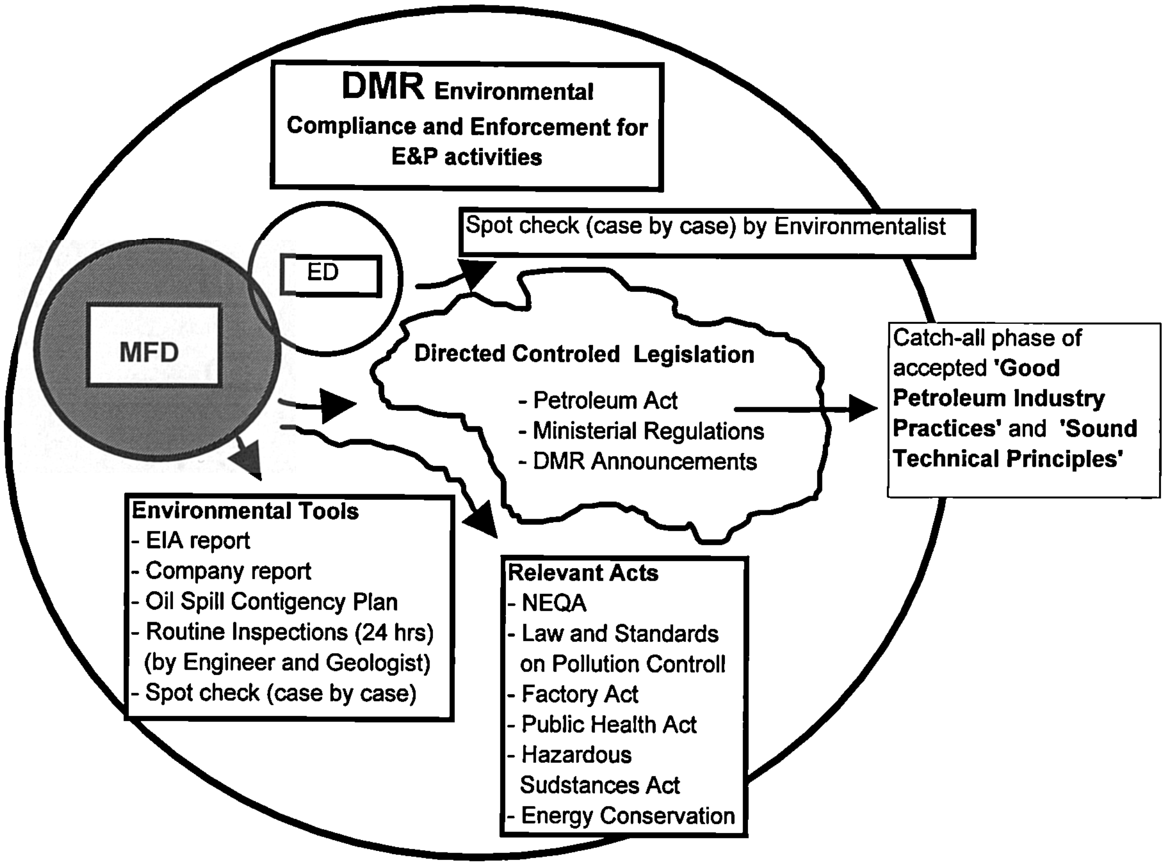


Fig. 9-7 Comparison of the current of Environmental Compliance and Enforcement Pathways between Thailand and UK



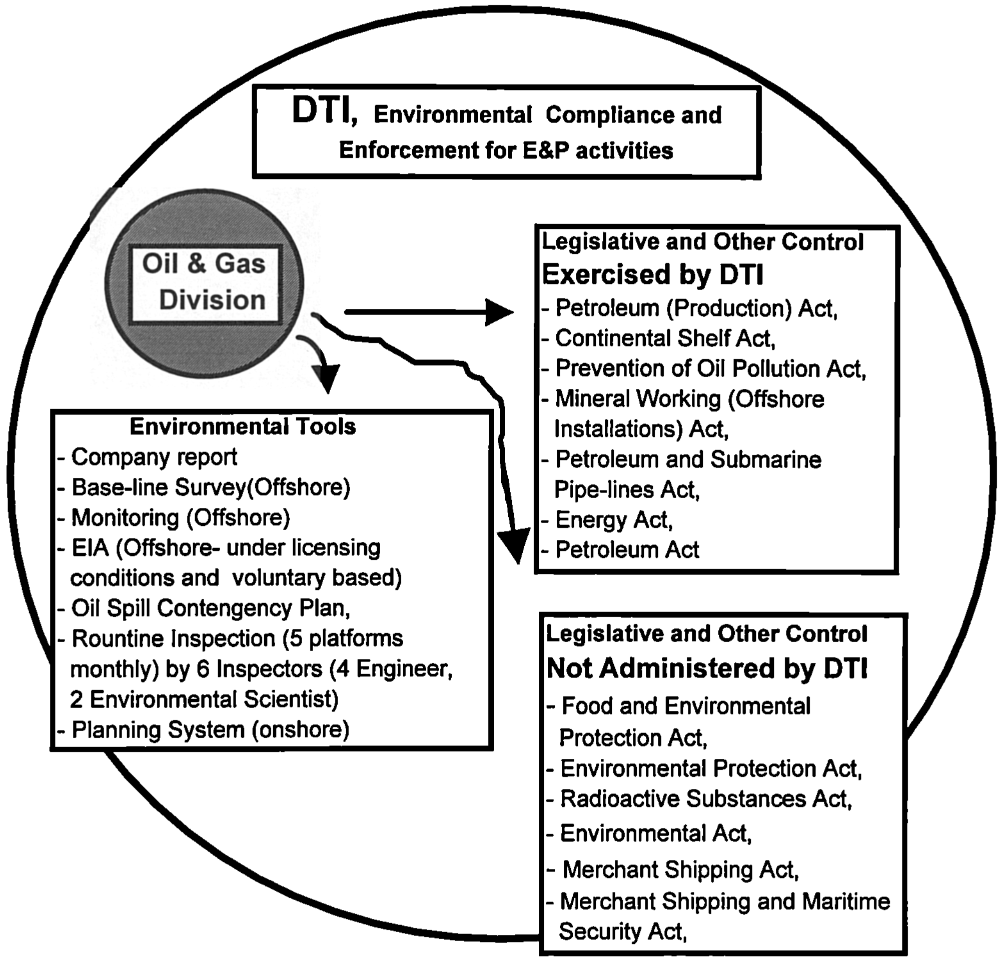


Fig. 9-8 Comparison of the current Environmental Compliance and Enforcement Pathways Between DMR and DTI

At present, all capacities of oil & gas activities require EIA reports by the Office of Environmental Policy and Planning (OEPP), with approval of the National Environmental Board (NEB) which falls under various (11) government bodies and (8) Ministries and consisting of the Prime Minister as the Chairman, a Deputy Prime Minister as the first Vice Chairman and the Minister of MOSTE as the second Vice Chairman. DMR and OEPP work closely together for EIA processing, so the information of environmental compliance and enforcement flow between them, and between the other relevant authorities. In 'hot' environmental issues regarding oil & gas activities, the DMR's environmental compliance and enforcement information might be given (information flow) to the Public by the Pressure Groups, media (Newspaper), and Universities.

In UK system, the environmental compliance and enforcement regarding oil & gas activities are controlled directly under Oil & Gas Division (OG), DTI. There are seven Sections concern with environmental control, and most of the officers are Engineers, Geologists, and Environmental Scientists. The Sections must report all their activities (both in office work and field work-routine inspections) related to the environment to the Director of OG. Then the Director should report directly to Director of Energy, and the Director of Energy should be report to Minister of Energy. The DTI also work closely with the other relevance authorities and UKOOA, so the information of environment management flows between them. Also NGO / Pressure Groups influence DTI decision-making, so the information flows between them too. The information flow of environmental compliance and enforcement system in Thailand and UK are generally compared in Fig. 9-9 and Fig. 9-10.

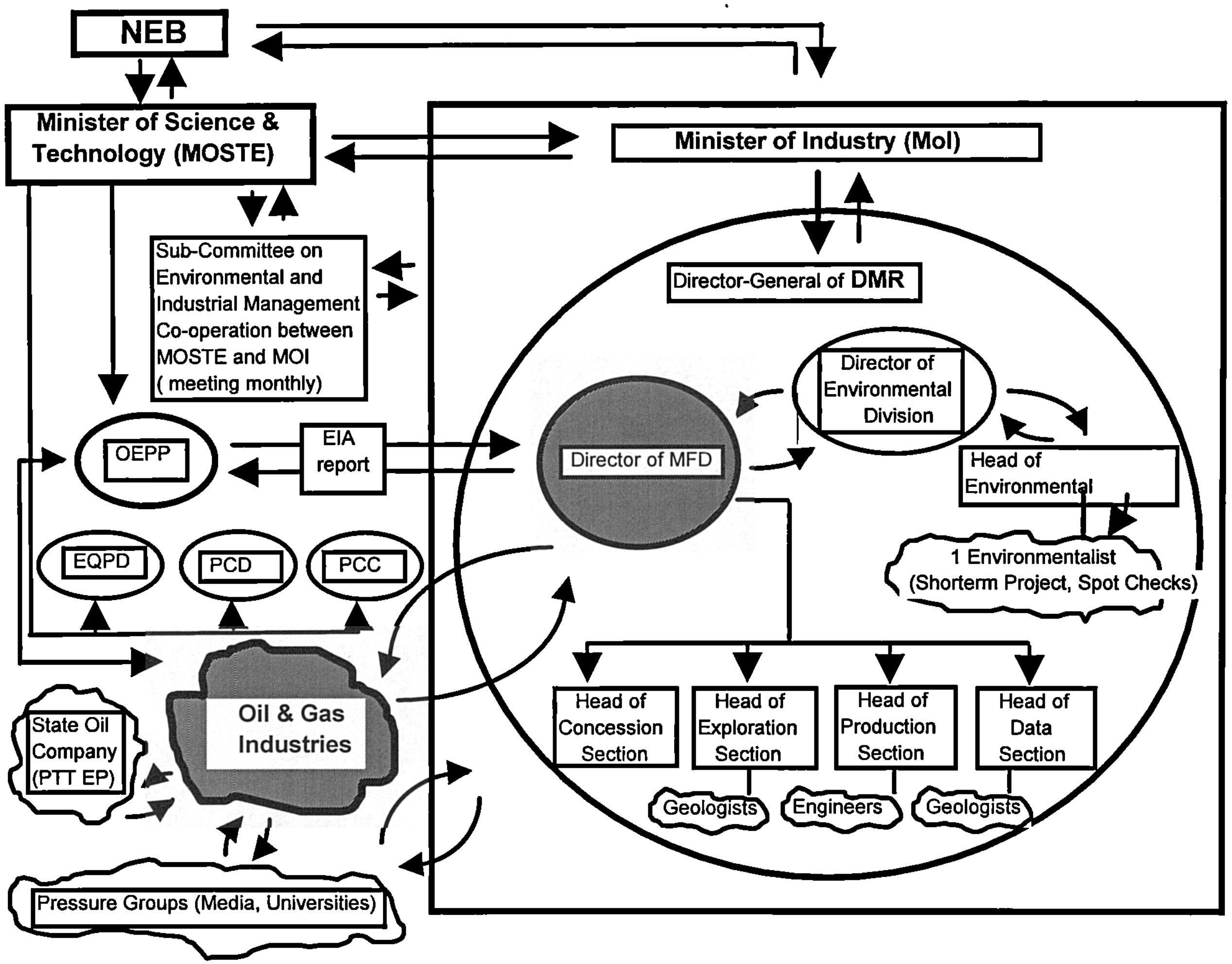


Fig. 9-9 Thailand, DMR, Environmental Information Flow System

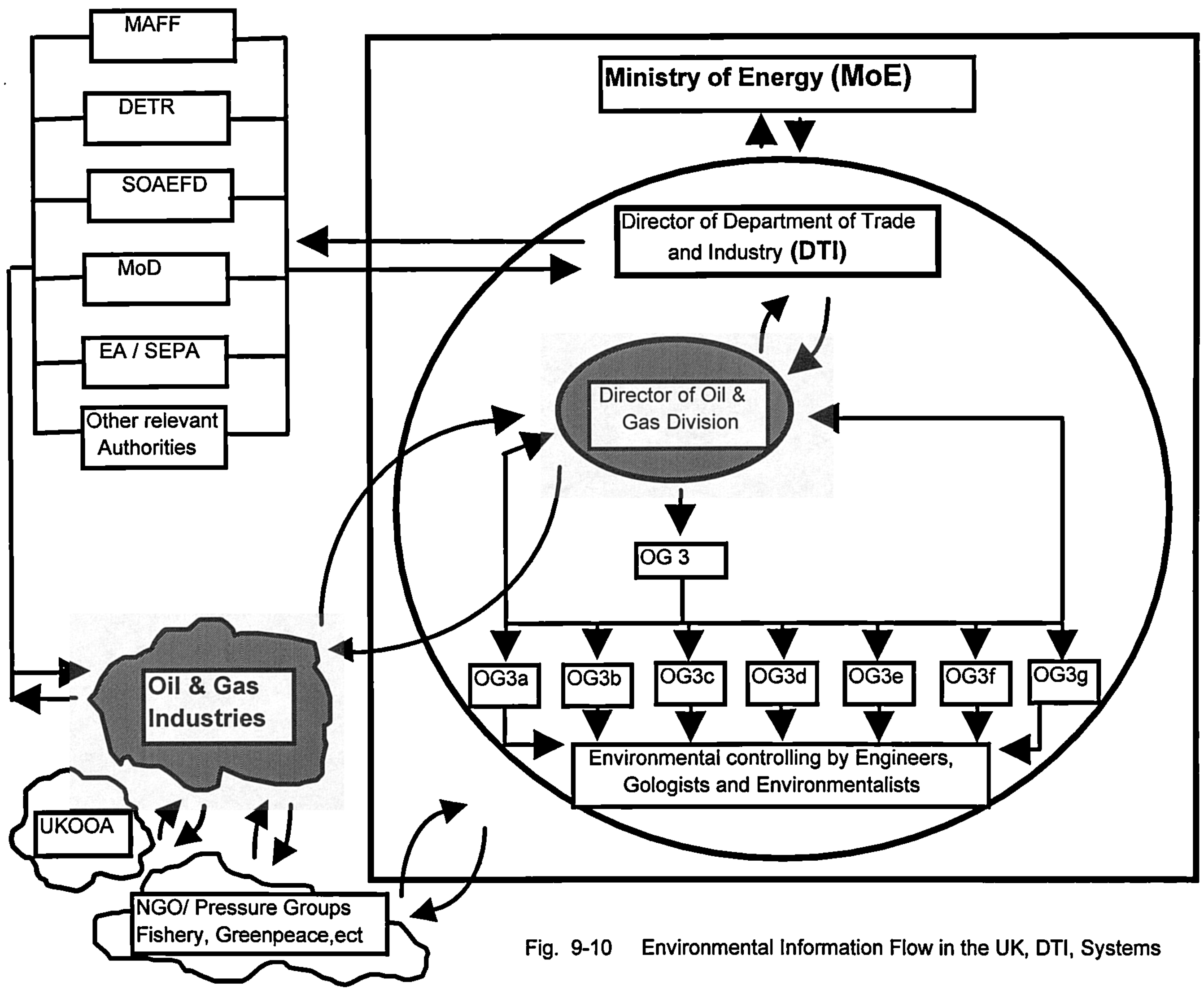


Fig. 9-10 Environmental Information Flow in the UK, DTI, Systems

9. 5 Comparison of the E&P Industry Development Characteristics between Thailand and UK

The E&P industry development characteristics between Thailand and UK are summaried in general in Table 9-7. It is obvious that oil & gas activities in Thailand on a smaller scale and have a shorter history than the UK. Most discharges or oil spill information in Thailand is not published as it is in UK.

Table 9-7 Comparison of the E&P Industry Development Characteristics between Thailand and UK

Activities	THAILAND	UK
First exploration	began in 1921	major exploration activities stared in UKCS 1964
First productions	began in 1981	onshore oil - in 1913 offshore gas - in March 1967 (first production gas well was found in 1965, first oil field discovered in1971)
No. of wells drilled	1088 (as of 1994) (932 in the Gulf)	in 1995 - 98 (Exp & App well) • 244 (Dev well-offshore) • 19 (Dev well-onshore)
E&P activities overview	• small to medium scale • short history	• big scale • long history
Licensing	licensing granted by DMR under the Petroleum Act 1971.	Granted by DTI under the Petroleum (Production) Act 1934. Landward License is included by planning permission.
Licencing Round / Bidding	16th rounds (up to 1995)	up to 1996, offshore - 17th rounds onshore -7th rounds
Concessionaires No.	29 (up to 1995) *(44 Exp. block, 18 onshore, 26 offshore)*	no information
Success ratio	2 : 5 *(onshore 1:5, offshore 3:5 (in the Gulf) and 0 in the Andaman Sea)*	- exploration success 1 : 4 (offshore exploration), - average discovery rate 1:6
Petroleum fields	- *as of Feb 1995,* production fields (10 onshore, 8 offshore)	as at March 1996 - 169 fields (101-oil, 68-gas), *oil fields - 81offshore, 20 onshore, gas fields - 62 offshore, 6 onshore*
Reserves	as at Jan 1995 oil - 491 MMBBL, Condensate - 494 MMBBL gas - 17.6 TCF	at the end of 1995 oil-1,890 million tonnes gas-1,915 billion cu.ft
Production rate (BBL/D)	oil - 23,005; gas - 1,094 MCF; Condy - 30,554	oil - 319.8 thousands of tonnes/day (in 1995)
Gas Flared	no information	6.27 (MCMPD) (in 1995)
Produced Water discharged	no information	192 million tonnes from 55 platforms (in 1995)
Oil discharged with Produced water	no information	5855 tonnes (in 1995)
Oil discharged on drill cuttings	no information	3180 million tonnes (in 1995) (94 wells drilled using oil-based mud) from 342 total well drilled
Oil Spills	no information	• Total No. 145 (in 1995) • Total amount 84 (tonnes)

9. 6 Comparison of the present legislative controls Inputs and Disturbances for Oil & Gas Activities between Thailand, UK, USA, and the Netherlands

The offshore oil and gas can be described by its three main activity phases, Exploration, Production, and Decommissioning. Each of these phases leads to inputs and disturbances to the environment. In UK, USA and the Netherlands, most of these discharges are subjected to statutory control through the National Acts of the country. In some such as drilling discharges and produced water the legislation is detailed and technology complex. In others such as drainage there is little control and only basic technology. Most of the standards or requirements of the UK, USA and the Netherlands Act / Regulation are not widely different. Only some parameters have different control, such as

- oil content in produced water in UK and the Netherlands is limited to a maximum for any one day of 40 mg/l, but in USA is limited at 42 mg/l and USA also require for a monthly average of 29 mg/l too, but not in UK or in the Netherlands yet.
- A flow rate of water base muds discharge, heavy metal in oil based muds in USA are limited, but not in UK,
- air emissions are limited in USA, but not in UK. See comparison present legislative controls in Table 9-8 to Table 9-13

Compared with Thailand, currently, there are no special detail limitations, standards, or guidelines for E& P industry. The Present Act (Sec.75 of Petroleum Act) require that the concessionaire shall take appropriate measures in accordance with good petroleum industry practice to prevent pollution of any place by oil, mud or any other substance. There are no special discharge standards regarding this activity.

However, ADB (1993) recommended that Thailand should set up the guidelines and standards for discharge wastes from oil & gas industry by applying the universal E&P guidelines and standards. The ADB's standards are the same as used in the North Sea countries and not so different from USA, such as the limitation for oil content in produced water and it is prohibited to discharge in water depths of less than 15m or within 5 km of sensitive resource, oil wastes from machinery spaces shall not exceed 100 ppm oil, oil-based muds cuttings in water depths of less than 15 m within 5 km of a sensitive resource.

Table 9-8 Comparison of the present legislative controls regarding Drilling Phase

Parameter	UK	USA	Netherlands
Diesel Muds	Use prohibited	Use prohibited	Use prohibited
Oil Based Muds Toxicity Testing	A variety of toxicity tests used, including 72h EC_{50} of Skeletonema costatum, LC_{50} of Acartia tonsa, and a sediment reworker test using Corophium volutator. Bioaccumulation, adsorption, biodegradation and taint also considered. Structured decision tree used in considering results.	Minimum 96- hour LC_{50} of the SPP shall be 3% by volume	Must be approved for health and safety reasons.
Use of Oil Based Muds	Allowed for safety and geological reasons only	Allowed	Oil Based muds are permitted to be used only in very specific circumstances.
Discharge of whole muds	Prohibited	Prohibited	OBMs are recycled, the non-recyclable parts incinerated, and the associated cuttings brought to shore. Oil will be removed from these cuttings prior to landfill or use as hard-core.
Discharge of Oil on cuttings	All discharge must not exceed the standard of 10g oil/kg dry cuttings	No free oil. Effectively prohibits discharge.	Discharges were banned in 1993. Onshore disposal
Analysis of oil on Cuttings	50 ml retort daily or every 1,000 ft drilled	Statistic sheen test. 15g in 1,000 cm^3 H_2O for 1 hr. Examined for presence of sheen.	N\A
Metals	None	*Mercury* : 1 mg/kg dry weight maximum in the stock barite *Cadmium* : 3 mg/kg dry weight maximum in the stock barite	None

Table 9-8 Comparison of the present legislative controls regarding Drilling Phase*(continued)*

Parameter	UK	USA	Netherlands
Monitoring	Exploration : none Production/ Development : defined seabed sampling relating to the area of contamination.	Not Known	No Statutory requirements.
Water Based Muds Discharge	None	Same stipulations before discharges as oil based, i.e. no free oil, toxicity, metal content of barite stock.	WBMs are recycled, the non-recycled parts and associated cuttings being dumped at sea. Use must be approved by Inspector General of Mines
Flow Rate		Alaska : Water Depth >40 m : 1,000 bbl/hr >20-40 m : 750 bbl/hr 5-20 m : 500 bbl/hr <5 m : No discharge Gulf of Mexico : maximum 1,000 bbl/hr No discharge - Within 1,000 m of areas of Biological concern.	
Addition of Oil	Should be avoided wherever possible, may be added for I) workover operations, ii) well stimulation and completion, iii) emergency drilling only approved low toxicity to be used. Any WBM contaminated with oil must be isolated and disposed of onshore.	Discharge dependent on toxicity / free oil presence.	Will be treated as OBM, i.e. no discharge.
Pseudo Oil Muds / Synthetic Muds contaminated cuttings	- The mud must be categorised in accordance with the requirements of the OSPARCOM Harmonized Offshore Chemical Notification Format 1995 (HOCNF). This decision reduced and now prohibits conventional mineral oil-based cutting discharges at more than 1% oil - on-cuttings from 1/1/97 for all wells drilled anywhere on the UKCS. - The discharge of synthetic mud contaminated cuttings on the UKCS will be reduced to effectively zero by 31/12/2000	Treated as Oil Based Muds	Not Known
	- The company will reduce its discharges by at least 20% each year using a 1996 baseline in order to achieve the deadline by 2001 (except ester based muds) - Any oil contamination before discharge of cuttings will required exemption from POPA 71.		
Use of Chemical	Revised in accordance with requirements of the OSPARCOM HOCNF. Thresholds are stipulated for the notification of certain chemicals with respect to their discharge levels.	Not Known	Must be approved by Inspector General of Mines before use. Added Chemicals discharges should be reduced and the industry will use the CHARM model as a basis for their reduction.

Table 9-9 Comparison of the present legislative controls regarding Produced Water

Parameter	UK	USA	Netherlands
Oil Content	Not to exceed 40 mg/l calculated as monthly average. No more than 4% of samples tested should exceed 100 mg/l.	a maximum for any one day of 42 mg/l and a monthly average of 29 mg/l	A maximum allowable monthly average oil content of 40 ppm. However reinjection is regarded as best practice but only where no additives.
Heavy Metals & Benzene	None	None	Mercury 8.3% Cadmium 1.8%, Lead 9.6%,Zinc 18.5%,Nickel 2.5%,Benzene 6.8%
Aromatic Oil Content (PAHs)	None	None	Steam stripping (offshore) as best practice, but investigating the use of air stripping followed by biofiltration (a technique used in contaminated land clean-up in the terrestrial environment)
Chemical Content	Revised in accordance with requirements of the OSPARCOM HOCNF. Thresholds are stipulated for the notification of certain chemicals with respect to their discharge levels.	Not Know	Must be approved by Inspector General of Mines before use. Added Chemicals discharges should be reduced and the industry will use the CHARM model as a basis for their reduction.
Total Stream of Water **Flow Rate**	Continued	Continued *Alaska :* no discharge *Gulf of Mexico :* No Discharge within in 1,000 m of an area of biological concern	Continued

Table 9-10 Comparison present legislative controls regarding Drainage

Parameter	UK	USA	Netherlands
Oil in Water Content	Oil or oily mixtures associated with drainage must not exceed 15 ppm (without dilution).	No free oil to be discharged.	Avoidance of oil discharged as far as possible. 40 mg/l aliphatic oil in water content.
Oil in Water analysis	None	Solvent extraction / IR spectroscopy	Static sheen test.
Requirements for monitoring	None	Not known	Daily analysis solvent extraction/IR technique

Table 9-11 Comparison of the present legislative controls regarding Flaring *(ERT,1994)*

Parameter	UK	Netherlands	US - Gulf of Mexico(6)	US - North California
CO_2	None	None	None. Voluntary discharge reporting scheme.	None
NO_x	None	None	666 tons/yr (3) 3330 tons/yr (4)	Source dependent, e.g. turbines 42 ppmvd at 15% O_2 for units rated under 3MW. Permitted levels determined by Best Available Control Technology (BACT).
SO_x	None	None	666 tons/yr (3) 3330 tons/yr (4)	New sources: fuel gas sulphur content <30 ppmv distillate fuel <0.05% by weight.
TSP (5)	None	None	666 tons/yr (3) 3330 tons/yr (4)	Not known
CO	None	None	70 x 10^3 tons/yr(3) 350 x 10^3 tons/yr(4)	Source dependent. Levels determined by BACT
Total venting volume	Maximum daily amount permitted.	None	None	Venting prohibited. All produced gas must be collected.
Total flare volume	Maximum daily amount permitted for each installation.	None	None	20% opacity standards. Flaring events must be minimised.

(1) Sofia Convention 1989
(2) Helsinki Agreement 1985
(3) 20 miles offshore
(4) 100 miles offshore
(5) Total Suspended Particulate
(6) if potential to exceed these levels exists, operators must demonstrate that they do not affect onshore ambient air quality model, before a permit will be issued.

Parameter	UK	Netherlands	US - Gulf of Mexico	US - North California
Flaring of well fluids	Permit required	None	Included in total	Prohibited
Total VOCs	None	None	666 tons/yr[1] 3330 tons/yr[2]	3 monthly inspection/repair schedule for fugitive HC emissions. All produced gas must be collected.

(1) 20 miles offshore
(2) 100 miles offshore

Table 9-12 Comparison of the present legislative controls regarding VOC emissions *(ERT,1994)*

Parameter	UK	Netherlands	US
Total halon use	85% reduction by 1994 (based on 1986 levels), 100% reduction by 1996*	85% reduction by 1994 (based on 1986 levels), 100% reduction by 1996*.	50% reduction by 1995 (based on 1986 levels). 100% reduction by 2000.
Offshore fire fighting	Permitted under strict control.	Not known	Not known
Production	Prohibited from 1 January 1994.	Prohibited from 1 January 1994.	Prohibited from 1 January 1994.
Import/ Export	Prohibited from noi parties to Montreal Protocol.	Prohibited from non parties to Montreal Protocol.	Prohibited from non parties to Montreal Protocol.
Halon tax	None	None	S2.65 x ODP (ozone depleting properties)/16 (rising annually by S0.45 x ODP/16.
Declaration	Products containing halons listed.	Products containing halons listed.	Products containing halons listed.

* little offshore control

Table 9-13 Comparison of the present legislative controls regarding Halons *(ERT,1994)*

9.7 The comparison of the EIA systems

a) EIA requirement for E&P industry

In Thailand, In March 1996, EIA is required for all capacities of Explorations and/ or Production of Petroleum (both onshore and offshore development area), include all capacities of Petroleum and Fuel Oil Transportation system by Pipeline. However, the Act did not give details or guidelines of EIA for E&P industry yet.

In UK, as the direct result of EEC Directive, EIA has been carried out for onshore oil & gas developments such as oil reception terminals and oil and gas processing facilities but are not generally required for offshore oil & gas development. EIA could be required as a condition under the onshore planning laws and as used extensively in the onshore development of oil & gas facilities (it was required from 1988). EIAs will be mandatory for onshore oil & gas developments only where Member States consider that their nature, scale or location so require.

In USA, The US Federal EIA system is based upon the broad provision of the National Environmental Policy Act (NEPA)1969. The substantive intent of NEPA, to change the nature of federal decision making, has been gradually whittled away over the years to become a largely procedural requirement, the legal basis of the US EIA system is clearly specified by it.

In the Netherlands, EIA is required by EC Directive 85/337 as in the UK. This is implemented through the Environmental Protection (General Provisions) Act of June 1986; the EIA Decree of May 1987. Currently, EIA for Offshore Oil & gas activities are not required by Act, but it will be required in nearly future by the direct result of EEC Directive. The EIA systems in three countries are compared in Table 9-14.

Table 9-14 comparison of the EIA systems in UK, USA and the Netherlands

Countries	Comment
Legal basis	
UK	- Regulations specifically implement European Directive on EIA, EIA integrated within town and country planning system, administered by local planning authorities (LPAs).
USA	- National Environmental Policy Act and Regulations clearly define separate EIA system.
Netherlands	- EIA Act and decrees specifically provide for clearly defined EIA process integrated into other decision-making procedures.
Coverage	
UK	- Comprehensive coverage of projects approved under town and country planning process.
USA	- Applies only to federal, not state or most private, projects: comprehensive coverage of impacts of significant federal actions (including some non-project actions)
Netherlands	- Covers highly significant projects and certain policies, plan and programmes.
Alternatives	
UK	- No regulatory requirement. Regulations permit consideration of alternatives and guidance advises it, practice varies.
USA	- Treatment of alternatives required in almost every environmental assessment and lies at 'heart of environmental impact statement' (EIS)
Netherlands	- Alternatives, including the 'no-action' and the environmentally preferable alternatives, must be considered in scoping, the EIA report and the decision.
Screening	
UK	- Use of lists of projects, indicative criteria and thresholds in screening by LPAs varies.
USA	- Use of categorical exclusions, inclusion criteria, and (rarely, in practice) environmental assessments to determine significance of impacts.
Netherlands	- Lists of activities, thresholds and criteria in EIA Decree allow competent authorities little discretion
Publicly reviewed	
UK	- LPA may request further information and proponents usually provide it. Proponents under no duty to respond to comments.
USA	- Lead agency must responsed to agency and public comments on published draft EIS in final EIS.
Netherlands	- EIA Commission reviews the EIS and, where necessary, supplementary information is requested by competent authority
Decision-making	
UK	- Environmental information is a material consideration but not necessarily a central determinant. Practice varies.
USA	- Explanation of decision and disclosure of environmental effects mandatory.
Netherlands	- Explanation of way environmental impacts considered in decision is mandatory. In practice, EIA generally does influence decision.
Monitoring	
UK	- No provision for monitoring. Uncoordinated implementation monitoring takes place under planning and other legislation unrelated to earlier stages in EIA process.
USA	- Monitoring essentially discretionary but some requirements where mitigation measures specified in record of decision.
Netherlands	- Practice often weak
Mitigation	
UK	- ES must cover mitigation and LPAs impose conditions upon permissions to mitigate impacts.
USA	- Formal requirement to incorporate mitigation measures in record of decision.
Netherlands	- Mitigation is subsumed in treatment of alternatives but is not separately required.
Consultation	
UK	- Some voluntary consultation and participation takes place following ES release.
USA	- Consultation and participation take place at several stages in EIS preparation.
Netherlands	- Formal requirements for consultation and public participation in both scoping and review.
System	System Monitoring:
UK	- No formal general requirement to monitor but some records published. EIA system review undertaken, and changes made to improve operation.
USA	- Council on Environmental Quality charged with general oversight of EIA implementation. Numerous reviews undertaken and amendments made.
Netherlands	- EIA commission prepares annual report and a comprehensive quinquennial EIA system review is undertaken
Costs & Benefits	
UK	- *Consensus (but not unanimity) as to utility of EA in improving project mitigation measures.*
USA	- Virtually unanimous view by proponents, consultees and the public that benefits of EIA exceed its substantial time and other costs.
Netherlands	- Virtually unanimous belief that benefits of EIA outweigh its financial and time costs.
Strategies EA	
UK	- No formal requirement for SEA. Guidance on environmental appraisal of both central government policy and of local land use plans exists. Some practice.
USA	- 1969 Act provides clear legal provisions for SEA. SEA practice developing stead
Netherlands	- EIA Decree defines 'proposal' to include certain policies, plans and programmes.

9. 8 Comparison of Environmental Voluntary Agreement Approach in the Netherlands and the United States

The other different points about environmental management system for oil & gas activities in Thailand, UK, USA and the Netherlands is pollution control by a voluntary agreement approach. The environmental management systems in the Netherlands and the USA not only control the present pollution they also have a plan to protect / control the pollution from oil & gas industry in the future too, which is different from Thailand where there are no such plans. At present the Netherlands and the USA have introduced the environmental voluntary agreement approach (in Netherlands called 'Environmental Covenants', in USA called 'Natural Gas STAR Producer programme) to control the pollution by setting up the pollution reduction targets year, but this has not happened yet in Thailand.

a) The similarities in this Environmental Agreement

Both of this two agreement are based on voluntary approach. It is the agreement between the Government and the upstream oil & gas industry. The general purpose of both of the agreement are target reductions for quantity of pollution from oil & gas activities for a period of years. The responsibility for the environment lies on the companies. The target is weighted to find an optimum in the measures proposed by the companies and judged by the authorities. Both of the agreements require company environmental plan.

b) The differences in Environmental Voluntary Agreement

Targets Purpose : However, the purpose of the Natural Gas STAR programme in the USA is covered only to reduce methane releases to the atmosphere by implementing, and continuing, cost effective emission reduction technologies and operational practices. This environmental voluntary programme of the USA is different from the Environmental Covenant of the Netherlands. The purpose of the environmental covenants of the Netherlands cover Air emissions, Heavy metals & Benzene in Produced Water, Oil Discharges, Radioactivity, Organo-halogens, PAHs, Added Chemicals, Offshore Waste Flows, Drilling Muds, and Cuttings.

Target years: The Netherlands Covenants or Agreements are made for the mid to long term. Target in the Covenants is for a period of 10-20 years which is year 2000 and 2010 by using 1990 as a baseline year. Company Environmental Plans (CEP's) for a period of 4 years. In the Natural gas STAR Producer Programme of the USA, the partner agrees to implement practices and technologies, as appropriate, according to the provisions of the Partner's implementation plan, within 3 years of submission.

9.9 Application of UK, USA and the Environmental Compliance and Enforcement in Thailand

9.9.1 Suitability of UK environmental compliance and enforcement on Thailand

The UK environmental compliance and enforcement regarding to upstream oil & gas activities are quite complex compare with Thailand. The pollution from activities is controlled by various authorities and law. Onshore and offshore activities are controlled differently. However, there are some strengths of the UK system which could be applied to Thailand, such as guidelines, standards, and some environmental requirements such as base-line survey, monitoring. Also the UK routine inspections by using a formal confidential environmental checklist form could be applied to Thailand.

In the other hand, the UK regulatory system (various Law and Authorities) would not suit Thailand, because Thailand's compliance and enforcement may become more problematic than the current situation and might distract foreign investors. Oil & gas activities in Thailand are still on a small scale so, it is not too complicated for Thailand to management the pollution from this activities by using a simple compliance and enforcement.

9.9.2 Suitability of (Pollution Quality Control - Concentrate level) of the UK, USA, and the Netherlands Standards or limitation

The pollution quality control by limiting the concentration of the discharge (standards) from oil & gas activities as in UK, USA, or in the Netherlands are universal in their application and probably reasonable. The standards have been determined on the basis of technical feasibility which should be well proved by evaluations of scientific data and information and seek to apply generalized risk assessment to individual situations. Thus, these standards should be practicable and reasonable for application to Thailand, because most of the oil companies are international and have high work experience in there areas. However, tighter or looser environmental standards than international standards should be reviewed to suit with Thailand circumstances. The standards should not be too tight, because it might distract foreign investors which would be against government policy which has been trying to attract economic activities especially to meet its energy goals, while at the same time implementing a sound environmental management program.

9.9.3 Suitability of Environmental Voluntary Agreements (Environmental Quantity Control Approach) on Thailand

a) Environmental Covenants : The Workgroup E&P Covenants of the Netherlands opinions

The covenant could be made to work in Thailand but this would depend on the maturity willingness and environmental awareness of the government and industry. However, it might have manpower problems for paper work, because the covenants require so much.

Mr. Kees Meijer (1997) mentioned that the covenant could possibly work in Thailand, because the international oil & gas companies, which have their operation in the Netherlands) will have experience with covenants. The covenants are more flexible than regulation to help the country (Thailand) reach the their goal / target to make economic run and protect environment. The legal regulations always take time to change. *(source: by interviewed Mr. Kees Meijer, Environment Department).*

Dr. W.J.van der Have (1997) pointed out that ' ..... there is a growing interdependent between countries (economic, political and social) and subsequently there is a shift in environmental attention from a national to an international level. The aim of developing nations is to improve the standard of living of their population. They will try to attract economic activities in their countries. These developments will have an impact on the environmental policies to follow. The excessive use of law as an environmental policy instrument might detract foreign investors. Also enforcement may become problematic. On the other hand tighter environmental targets than international targets could be desirable subject to the local circumstances. The Environmental Covenant instrument could be used in several situations :

1. Results can be obtained, preceding regulations which are being developed,
2. The contents of regulations which are being developed can be applied and tested already,
3. Existing environmental regulations can be sharpened or supplemented,
4. The environmental targets cannot be met fast enough by using regulations.

An Environmental Covenant can unite effectively in dealing with environmental problems and the flexibility important to the functioning of economic sectors. The agreements in the covenants should be binding ' *(Have,1997).*

Dr. Jelle W Nijdam (1997) stressed that covenants can only be successful if they can meet the following conditions :

1. the industry must show their awareness to environmental problems,
2. the industry must be willing to take measures for the environmental problems,
3. the government must understand the problems of the industry and be open to exchange solutions,
4. the government must be prepared to hold up regulation and legislation and give the responsibility to the industry.

As Thailand's currently situation shows that both government and industry are not ready. Therefore, covenants for all the environmental problems in Thailand are not regarded as suitable. However, covenants dealing with specific parts of the problems (e.g. pollution due to dumping of produced water) can be successful *(Nijdam,1997).*

Mr. Ronald van den Heuvel (1997) Directorate-General of Public Works and Water Management of the Netherlands, noted that ... 'in the evaluation of the several covenants (including the Oil & Gas companies) it was concluded that it takes a lot of time to come to Company Environmental Plans (CEP). May be the time aspect for evaluate CEPs is something to consider for Thailand' *(Ronald,1997).*

b) The researcher' opinions

Both of the Environmental Covenants and the Natural Gas STAR program are approaches to reduce the quantity of pollution within the period of target years. Both the new approaches could be used to good purpose to protect the environment in the future. The new approaches could work well if the country has a mature environmental policy. On the other hand it requires much paper work.

In the case of Thailand, the country is not ready for the Environmental Covenants at least for another 5 -7 years. Because the current situation of Thailand, DMR, organizational and administrative aspects are unfocused and driven by laws. There are no specific Act or Regulations, guidelines or standards for upstream oil & gas activities. There is a lack of systematic work goals, strategies, action plans, protocols. Also, DMR' s human resources and skill are inadequate. Thailand needs to solve all of these problems as a first priority in the very near future. It must be realized that Thailand needs to control the present and accumulated pollution from these activities first. After that Thailand may start to apply the environmental covenants and / or STAR program for controlling the future pollution.

9.9.4 Suitability of ADB (1993)'s Recommendations

Some part of the Asian Development Bank (ADB)'s recommendations for environmental standards and regulations regarding upstream oil & gas industry in Thailand could suit Thailand in this situation.

a) Regulatory and administrative framework should form the basis for detailed review and discussion by relevant government and industry groups,

This recommendation could solve the main currently weakness of DMR environmental compliance and enforcement regarding to upstream oil & gas industry as follows; a) unfocussed Organizational and administrative aspects by laws, b) lack of concretely defined roles and duties to be undertaken by DMR, c) lack of driving regulations and standards make the fundamental remit and job-description vague and unclear. However, DMR should avoid superfluous Laws, complex rules, and unpracticable procedures.

b) DMR should act as a one-stop-shop for all upstream oil & gas activities

This recommendation could be solve the current weaknesses of DMR; lack of systematic work goals, strategies, action plans, protocols and guidelines; and should be fix with DMR currently system. At present only DMR has responsibilities directly to upstream oil & gas activities both onshore and offshore, except EIA process is not include in DMR responsibilities. Work as one-stop-shop should be more practicable both for DMR and the industries, because good management systems should be not to complicated and impracticable. One-stop-shop can reduce the problem of slow and complex decision-making processes.

c) DMR should establish its own environmental group for undertaking compliance audits of industry activities

This recommendation could be solve the weakness of DMR related to a) unclear demarcation of responsibilities and ineffective co-operation between MFD and ED, and between DMR and other agencies, b) lack of appropriately qualified and skilled personnel to carry out environmental compliance and enforcement work.

d) Concessionaire Environmental Reporting Requirements

ADB recommended that DMR should require an Application for Petroleum Development Activity (APDA), an Environmental Review (ER), an EIA, and the other environmental reports such as annual report on the total volume of discharges, emissions, and waste disposed of each activities, etc. This recommendation should help DMR to solve the currently weakness points about no formal environmental reporting requirements by DMR. DMR needs to require the environmental reporting from oil companies for information for DMR decision-making and environmental management.

e) Waste Handling Requirement

This recommendation will give DMR authority for standards, guidelines for environmental protection regarding pollution from oil & gas activities. At least the standards and guidelines are based on international / universal procedures, which should be reasonable and practicable for the international oil companies in Thailand too.

f) Training in Environmental Assessment

This recommendation should be help DMR to solve the weakness of lack of skilled personnel to carry out environmental compliance and enforcement work.

CONCLUSION

This thesis attempts to analyze and give recommendations for the main current weaknesses of DMR environmental compliance and enforcement regarding oil & gas activities in Thailand. It has been recommended that DMR carry out actions which fall into two main categories: **DMR capacity building, Enhance regulatory framework.**

The first recommended priority is that the DMR Director-General should set up a formal action staff / team in short-term (within 1-2 months) to have specific responsibilities to driving environmental compliance and enforcement related to oil & gas activities. The new team should have representatives from MFD and ED. This action team should prepare an action plan to enhance regulatory framework and DMR capacity building. The specific law, regulations, guidelines (in detail) and standards have to be enacted for the enforcement. The planning is necessary for long term development and have to be implemented seriously.

One of the strong recommendation of this thesis is DMR needs to set up a new Environmental Section within Mineral Fuels Division (MFD) to make the system work as a one-stop-shop as in ADB' recommendation. This new Environmental Section will have responsibilities for environmental compliance and enforcement for oil & gas activities.

The other recommendations are that DMR should promote development of a simple regulatory system based on sound science, technology, and cost-effectiveness. DMR should require environmental reports such as base line studies, self-monitoring, self-auditing, waste handling reports, environmental risk assessments, and spill emergency plans. Also DMR should have routine environmental inspections. DMR should provide environmental guidelines both for DMR officers and the industry.

Giving education / training and consciousness to the people (including the government officers, the concessionaire) is a long term process and needs to start as soon as DMR can do it in order to collect the fruitful results in the future.

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